Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "ELECTRICAL ENGINEER."

VOL. XLV. NEW YORK, SATURDAY, FEBRUARY 4, 1905. No. 5.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

114 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 7605 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE - - - - - - - - - 1139 Monadnock Block
PHILADELPHIA OFFICE - - - - - - - - 929 Chestnut Street
CLEVELAND OFFICE - - - - - - - - 402 Cuyahoga Building
EUROPEAN OFFICE - - Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION.

United States, Canada, Cuba or Mexico - - - - - Per year, $3.00
Foreign Countries, within the Postal Union - - - - - - - 6.00
Great Britain and Ireland - - - - - - - - - 25 shillings
Germany - - - - - - - - - - - - - 25 marks
France - - - - - - - - - - - - - - 31 francs
Single copies - - - - - - - - - - - - - 10 cents

Remittances for foreign subscriptions may be made through our European office.
In requesting your address changed give OLD as well as new address.

Copyright, 1904, by MCGRAW PUBLISHING CO.

Entered as second-class mail matter at the New York Post Office.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office by 10 a. m. Monday preceding date of issue. New advertisements will be accepted up to noon of Tuesday for the paper dated the following Saturday.

The exact circulation of the Electrical World and Engineer each week is stated in this column. Of this issue **15,000** *copies are printed.*

NEW YORK, SATURDAY, FEBRUARY 4, 1905.

CONTENTS.

Editorial 227
Van Depoele Trolley Patent Decision 230
Governmental Control of Wireless 230
Independent Telephony in Texas 230
Another Monument to Joseph Henry 230
Death of Edward Hemphill Mullin 231
Independent Telephony in Indiana 231
The January Meeting of the American Institute of Electrical Engineers 232
By Trolley Up Mont Blanc 232
Magnetic Survey of the North Pacific Coast 232
Telephonic Conditions in France 233
Annual Convention of the Independent Telephone Association of Wisconsin 233
American Telephone Statistics—III 235
Electrons and Older Freeholds 236
Engineering and Commerce 236
Use of the Telegraph in Warfare 237
Electrical Contractors' Association of Wisconsin 237
Electric Omnibus Line in Italy 237
Electrical Engineers of the Times—V. Philip Torchio 237
Current News and Notes 238
Central Station Work in Detroit—I 243
Results of Municipal Ownership in England 246
A Chinese Electric Railway System 248
Development of the Unipolar Dynamo. By James Asher 249
Unipolar Dynamos 250
The New Boston Edison Turbo-Generator Station 251
The Use of Sensitive Quadrant Electrometers 252
The Lighting of the East Boston Tunnel 253
Electrostatic Wattmeter 254
New Telephone Patents 254
LETTERS TO THE EDITORS:
Electric Omnibuses. By Wm. Lederer 254
Schenectady Electrical School. By Alex. M. Fenwick 254
Digest of Current Electrical Literature 255
Electricity in the Manufacture of Perforated Music 258
A Canadian Municipal Telephone Plant 259
The Stanley Rotated Jewel-Bearing Wattmeter 261
An Allis-Chalmers Group 262
Electrical Equipment for Chili and Peru 262
Troy Voltmeters and Ammeters 263
Weatherproof and Portable Telephones 263
Cartridge Fuse Cut-outs 264
Fault-Locating Instruments 264
Coal Handling Machinery as Applied to the Power House 264
Rheostats on Dynamo Test Board 265
Small Dynamo Electric Machinery 265
Queen Portable Photometer 266
Transformer Outfits for Thawing Pipes 266
Wireless Telegraph Performances 267
Atlas Water-Tube Boiler 267
Electric Display Signs 267
Industrial and Commercial News 268
General News of the Week 272

THE TRUTH ABOUT MUNICIPALISM.

The opposition to municipal ownership resolves itself in the final analysis into two elements. One is a fight for the maintenance of the good old principle of individual effort as against paternalism. The other is a contention or belief that the system of municipal ownership has not proved itself financially sound or economically successful. Both grounds of opposition have seemed valid to us, but we have often heard quoted the alleged wonderful results in England of certain plants. Up to the present time, however, it has been difficult to get a view of municipal ownership as a whole, although that is the only basis upon which it could be judged. We are glad to be able therefore to publish this week the remarkable summary and survey of the British situation presented by Mr. Schooling, who has taken the actual figures of all the 1,029 municipal "reproductive" undertakings, and massed them so that the truth emerges readily. It will be seen that, as a whole, the municipal business system is already in bankruptcy; that part of it is admittedly unprofitable, including the electrical plants; that even those which claim a profit do so with an absurdly small allowance for depreciation; that the real depreciation, if allowed for, shows a serious annual loss; that the burden of local taxation to support all these enterprises and fads is intolerable; and that the credit and solvency of the corporations, as a whole, is hopelessly besmirched.

Our readers should study the Schooling article for themselves. It is educational for them, and should be for some of their friends among the municipal agitators; and just as we print it we note a letter on the municipal indebtedness of England from Mr. Robert P. Porter to the *Chicago Chronicle,* in which he says: "What has been termed the 'costly ambition' of town counselors to embark in all sorts of municipal enterprises has not only deadened and taken all of the old-time vim and life out of British industrial enterprise, which at one time knew no bounds, but it has steadily absorbed all available money until the bankers themselves have become alarmed at the effect of this 'rake's progress' upon the national credit.' As everybody knows, Glasgow is running a business that includes everything from the cradle to the grave. Mr. Porter states that Yarmouth is going in for a municipal music hall; Huddersfield for a municipal bank, and London for penny steamers on the Thames. If Grout, Hearst and McClellan have their way, New York will soon give them pointers in this kind of financial folly.

THE GOVERNMENT AND WIRELESS.

A new bill for the control of wireless telegraphy is reported from Washington. Its main feature is the formal licensing of all private stations doing an interstate business by the Department of Commerce and Labor. All licensed stations must interchange messages at current rates and in time of war or public peril any station may be closed or turned to Government use by direction of the President, who also has power to establish regulations to prevent interference between private stations and those belonging to the naval or military systems. This bill is far more to the point than anything previously suggested. It does not propose a governmental monopoly of the wireless business, for indeed a clause specifically forbids Government stations competing with licensed plants in commercial messages. Experience elsewhere has shown that private enterprise is very necessary to the rapid development of a new art, and we should be sorry to see Uncle Sam take on any extensive business

enterprises until those he now struggles with are thoroughly purged of graft. But the public business of interchange of messages and commodities for that matter should be under rather closer control than now and we must admit that it would be a grave mistake to let so important an art as wireless telegraphy slip out of control.

After all it is for the public good that the rights of competing systems should be determined without needless delay and the compulsory interchange clause will act as an incentive to push patent litigation to a conclusion or to establish a *modus vivendi* at the earliest possible moment. The use of wireless along the coast raises some interesting questions that may have to be settled by international agreement, and therefore each nation should have such control as will enable it to act if necessary. Meanwhile the importance of tuning the stations is greater than ever and the system that first works out the problem will have the best chance of success and of living a quiet life, for we fancy Uncle Sam would be sufficiently glad to be free of interference to wink the eye of complacency if the tuned stations never happened to receive any messages via other systems. But on this point the proposed bill should certainly be clear, for it would work an intolerable hardship if a successfully tuned system capable of working its stations independently of all others were compelled to make provision for untuned messages. For such systems when they come some proper provision should be made which requires that Government control if applied should be somewhat flexible. But in view of the military importance of the art and its value to coastwise commerce we do not see how some official control can properly be neglected. Whatever its exact form, it should be liberal enough not to impede progress or to discourage enterprise. This is rather too much to expect under normal bureaucratic control, but the evil might be reduced to a minimum by placing the details of the control in an office with a special technical and administrative staff of permanent tenure, and subject as little as possible to interference from nominal administrative superiors.

CENTRAL STATION DESIGN.

Mr. Moultrop's paper read at the recent Institute meeting and reprinted elsewhere in abstract, together with the following discussion, on the splendid new turbo-generator plant of the Boston Edison Company is, although mainly descriptive, full of points of engineering interest. To begin with, the construction of the station was not hampered by the scant ground space usually so embarrassing a feature of design, so that the building is essentially a single-story structure save as convenience calls for basement or deck. In view of this it would seem hardly necessary to recite the usual chant about the compact and self-contained turbine as even a subsidiary reason for its adoption. In a station of which the buildings cover 2.67 sq. ft. per kw installed, the turbine goes in upon its operative merits and cost, which is one of the most striking features of the case in hand. We would much like to know, by the way, the actual cost of the station per kw capacity, including all equipment, for comparison with the cost of other large stations of recent design using turbines and reciprocating engines. We heartily approve allowing liberal ground space when feasible, since undue striving after compactness is the root of many evils, both in machines and in stations; but we are far from clear as to the advantage of isolating the switching and controlling apparatus as completely as is done in this instance. It is enormously expensive and we question whether it will be as satisfactory in the long run as a little more intimacy between the man who handles the switches and the man who knows what is going on in the generator room.

Another of the few points open to criticism is the use of steam engines for driving the auxiliaries. When the steam taken by the five steam-driven pumps is rigorously measured up, we fear it will make the total steam consumption a quantity considerably larger than would look well in print. These little engines generally take steam almost like an escape pipe. The whole structure of the station is worked out on what might be called the cellular plan with each unit from furnace to switchboard as far individualized as possible, and when the whole plant is completed it will be divided, so to speak, by water-tight bulkheads into three 20,000-kw stations. The arrangement is one that seemingly would lead to remarkable immunity from breakdowns. The whole plant impresses one as being built to stay, and it certainly is one of the most finished and elegant of recent stations both in design and equipment. We shall await engineering details of its performance with the keenest interest. The Boston Edison Company has undertaken a great and notable work in transmission to suburban sub-stations, and it is of the first importance that its central plant should work with the utmost economy. We hope that exact data as to fuel and operating costs will soon be available, and we trust that the results will be worthy of the skill shown in laying the foundations for them.

HOMOPOLAR DYNAMOS.

The subject of homopolar dynamos, often called unipolar dynamos, has recently received fresh attention through a paper by Mr. J. E. Noeggerath, read at the last meeting of the American Institute of Electrical Engineers. The first little dynamo to be constructed by Faraday, the pioneer in the science and art of dynamo building, was a homopolar machine, with probably a fraction of a volt of e.m.f. He proposed to increase the voltage, however, both by making the apparatus larger, and also by connecting a plurality of such electromotive forces in series. Siemens constructed a variety of homopolar dynamos of the cylindrical type. Several types were made by Forbes and other makers in England. In this country Edison and Eickemeyer constructed homopolar machines about fifteen years ago, both of the disc and the cylinder types. The electromotive force of all these machines was relatively low. A length of one foot of active conductor, cutting a field of 10 kilogausses at a speed of 1,000 ft. per minute, will generate an e.m.f. of a little more than 1½ volts. Assuming that with belt-driven machines the cutting speed could be made 5,000 ft. per minute, the e.m.f. generated would only be about 7½ volts per foot of cylindrically revolving conductor. For discs at the same peripheral speed the e.m.f. would be less than half this amount, since the mean cutting speed would be only about half the peripheral speed. The low value of e.m.f. thus obtained required that a relatively large number of independently insulated segments should be rotated side by side and connected in series by brushes like cells in a voltaic battery. The total friction and contact resistance of all the brushes required made the prospects of a commercially successful homopolar machine uninviting in belt-driven machinery. In machines of large size it was believed that there would be less difficulty, owing to the increased length of the cutting conductors, but a large machine at a single step forms somewhat of a commercial venture.

The steam turbine, however, with its relatively very high peripheral running velocity has recently come to the rescue of the homopolar machine, and Mr. Noeggerath's paper describes the results obtained on a 300-kw. 500-volt turbo-homopolar built at the Schenectady works. The great advantage of the apparatus is that the armature core is a solid cylinder of soft steel. This is an ideal mechanical arrangement. Since the field produced by the stationary exciting coils cuts the armature core symmetrically, eddy currents will not tend to be set up in the mass, even at the highest speeds under no load, assuming the machine construction to be good, so that

the intensity of the field remains uniform around the armature. Similarly, there will be no tendency to change the magnetic condition of the armature during rotation,and consequently there will be no hysteresis. The armature winding consists of insulated copper strips mounted upon the surface of the armature core. There are twenty-four such strips in the machine described, connected to pairs of insulated steel slip-rings, one of each pair being on each side of the armature core. By fixed copper brushes resting on these slip-rings, and fixed connecting wires, carried through the mass of the stator, the successive armature conductors are connected in series. In order that there may be 500 volts at the terminals of the machine under load, the e.m.f. generated in each rod must be, say, 43 volts.

Various precautions are described in the paper to minimize the variations in magnetic field due to the reaction of the currents in the armature conductors under load, these reactions tending to produce local fluctuations of magnetism that may give rise to considerable waste of power, both in eddies and in hysteresis.. At ten thousand feet per minute, in a field of ten kilogausses, the e.m.f. per foot would be about 15 volts, so that less than three feet of active conductor would be capable of generating the required e.m.f. at that speed. The total brush friction is not nearly so serious as might have been supposed, amounting to rather more than 500 watts, according to the figures supplied. As the speed of rotation is increased, the friction of the brushes slightly diminishes, apparently owing to centrifugal force of the moving air tending to lift the brushes from the rings. The machine seems to present a great simplification of direct-current machinery, being a return to the smooth-cored type of armature, and involving complete elimination of the commutator as well as its problems. In fact, the dynamo becomes as much simplified by the advent of the turbine as the steam engine connected with it.

HEAVY ELECTRIC TRACTION.

The paper read by Mr. Potter before the New York Railroad Club and the following discussion, which we briefly noticed last week, formed one of the most important contributions to the subject with which we have been favored for some time, and we cannot refrain from again calling the attention of our readers to the facts there set forth. Mr. Potter's paper was, as one might expect from an engineer of his experience, a very clear-cut presentation of the technical advantage of electric traction on a large scale. It made, as every such paper must, a strong showing in favor of electric trains. We cannot, however, let his figures pass without comment, for however good a cause may be, it is not strengthened in the long run by over enthusiasm in culling the data. We must express doubt as to whether 0.5 or even 0.6 cent is a typical figure for the cost of electric power per kw-hour on electric roads. We wish it were, but it represents an extremely favorable case—rather what one would wish than what one expects to find in actual practice. As bare production expense the figures may sometimes go, but when one is making a comparison of a central power station plus electric locomotives, with steam locomotives which require no central power station, interest and depreciation on the difference in cost should be vigorously figured and not left hanging in the air. An efficiency, too, of 78 per cent. from bus-bars to train must be classified as attainable rather than typical. We also have doubts as to the advisability of reducing the train crew on electric trains at large, however justifiable it may be in special cases. These things depend on density of traffic and many variable factors, so that general conclusions must be made very cautiously.

The status of alternating-current traction formed an incidental but very interesting feature of the discussion. Here Mr. Potter and Mr. Lamme took radically different positions, the former affirming its operative success, but damning its commercial probabilities with faint praise, while the latter came out strongly in its favor. Messrs. Sprague and Arnold sided substantially with Messrs. Potter and Lamme respectively, the one voicing a lurking distrust of alternating-current methods, the other holding that not one road in a thousand in this country could be commercially equipped with the direct-current system, while many could be advantageously equipped with a high-potential, alternating-current system. In this connection he mentioned the Leonard plan, which we have several times referred to in discussing its recent adoption by M. Huber, of the Oerlikon works. It is very evident that wide and apparently irreconcilable differences of opinion exist among well-informed engineers as to the commercial usefulness of the commutating alternating-current traction motor. Mr. Potter's statement that the extra weight and lessened efficiency of the alternating-current motors about offsets the saving in power from the elimination of rotaries, would indicate that one or the other of these estimable machines was in a rather bad way, while Mr. Lamme's account of a 1,500-hp alternating-current freight locomotive would suggest a very different viewpoint. Both these gentlemen speak with authority that comes from personal knowledge, and their difference of attitude is somewhat disconcerting to the mere railroad man who has to get his information about new apparatus via the engineers. The facts will be clarified in due time, but considering the many months that alternating-current motors have been before the public the situation is still technically muddy.

Mr. Wilgus appears to have struck the keynote of modern progress in large electric traction in saying that the power point of view was the increase in earnings rather than the decrease in expenses. Adopting electric traction means something much bigger and more far-reaching than mere change of motive power. It implies a radical improvement in facilities and in methods of treating traffic—a new economic situation in fact that is certain to work out in favor of electric traction in very many cases. This attitude is the most hopeful sign of the times. A few years ago we would have had the electrical engineers a unit on something or other and the railroad experts skeptical and reluctant. To-day we find the practical railroad man enthusiastic and full of confidence, waiting only for the engineers to settle their difficulties between themselves. Big electric traction is making good progress. It will come in good time, and railroad men, however conservative, will be ready to receive it. It waits to-day for Mr. Potter and Mr. Lamme and Mr. Sprague and Mr. Arnold and the rest to take off their coats once more and clear the way of some manifest difficulties. And however the great case of Direct vs. Alternating Current may turn out, we want again to express our profound conviction that the general electrification of railroads is not all going to come via 650 volts and the third rail. However good that combination may be as a solution of special difficulties, something better must be had to fit the general or even the average case. Mr. Sprague with his long experience and clear view is probably quite correct in saying that there are conditions which are prohibitive of electric operation. Be it so—the better the motors and the higher the working voltage, the fewer the cases in which the conditions will prove to be prohibitive, and the greater the number of instances in which the traffic density will be such as to admit and demand electric traction. And high-speed railroading waits as well. Is it seemly that smelly little automobiles should rip off miles in 35 to 40 seconds over a sandy beach while engineers hesitate at similar speed over a smooth track, backed by an entire power station?

Van Depoele Trolley Patent Decision.

As briefly noticed in our issue last week, Judge Wallace handed down an opinion January 23, on the part of the United States Circuit Court of Appeals sitting at New York, reversing the lower court and sustaining the re-issued trolley patent granted November 13, 1900, to Charles J. Van Depoele. The claims of the reissued patent were on a combination of a car, an overhead conductor above the car and an upwardly extending and lateral swinging arm mounted on the roof of the car, carrying a contact device at its free end and making underneath contact with the conductor, the arm being supported on the car on vertical and transverse axes so as to permit the contact to follow the position of the conductor, notwithstanding variation of height and lateral displacement. The lower court and also the Circuit Court of Appeals for the Sixth Circuit, had decided that the reissued patent was invalid for the reason that the invention therein specified had previously been described and claimed in a patent granted to Van Depoele on April 1, 1890.

Judge Wallace held that if the combination claimed in the reissued patent was new and useful, Van Depoele was entitled to make a claim for it, as for a sub-combination, notwithstanding additional means may have been necessary to place the specific parts in co-operative relations with the overhead conductor to affect the traveling contact. The tension device is not an element of the claims of the reissue and in none of the claims of the patent of April 1, 1890, was there one for a combination of the elements now claimed which did not also specify a tension device as an element. Nowhere in the prior art is there a combination between an overhanging conducting wire, under-running grooved wheel contact device and swinging arm mounted upon the car as are described in the patent. The swinging arm was old; the overhead wire and practically the same substantial arrangement with the tracks were old; a grooved contact wheel, but so mounted as to run upon a track was old, and tension devices to hold contact feeders in engagement with conductors were old. But Van Depoele was the first to point out to the inventors in this branch of the electrical art how modifications of construction and arrangement could be introduced which would substitute success for failure. The decision of the court was that the reissue is not invalid, that the inventions of the claim were not covered by the claims of the patent of April 1, 1890, and that the complainant is entitled to a decree for an injunction and an accounting.

Governmental Control of Wireless.

It is stated from Washington that on January 27 the Cabinet discussed the subject of Government supervision of wireless telegraphy. The matter was brought up at a Cabinet meeting about a year ago, and a special board appointed for the purpose of investigating it fully made a report to the President. The Adminstration's views have been embodied in a bill drafted by the Commissioner of Navigation, assisted by Capt. Seabury, of the navy, and others.

The bill provides that no person or corporation shall use any apparatus for wireless telegraphy in this country or upon any American vessel unless he be licensed by the Secretary of Commerce and Labor. Persons exchanging messages or signals between points situated in the same State or on behalf of the American Government are to be exempt from this requirement.

The official license is to provide that the President of the United States in time of war or public peril may close any wireless station, or authorize its use by the Government.

The President receives power to establish regulations which shall prevent interference between the naval and military wireless telegraph stations and private or commercial stations.

Each licensed station is to be required to answer calls and signals from any other licensed station and to receive all such messages or signals offered for transmission to a neighboring station, the rate to be that customarily required for such service. This requirement is to be observed regardless of the system used, on pain of revocation of the license.

Operation of any apparatus for wireless telegraphy on a foreign ship, while that ship is in American waters, shall be in accordance with the regulations prescribed by law. Government stations are prohibited from competing for commercial messages with licensed wireless stations.

Independent Telephony in Texas.

After some preliminary inquiry and work, a meeting was called at Dallas, Texas, on January 5 of the independent telephone leaders and companies in the State of Texas. The meeting was called to order by A. A. Miller, manager of the Dallas office of the North Electric Company, who had sent out the notices of the meeting.

Upon motion, Mr. E. W. Dunaway, general manager of the Paris Telephone Exchange, was elected temporary chairman and J. B. Earle, secretary of the Texas Telephone Company, and general manager of the Brazos Valley Telephone Company, both having headquarters at Waco, was elected secretary.

The president briefly outlined the purpose of the meeting and opened for discussion the question whether or not an independent organization should be formed. Upon a motion, it was decided to organize an association of the independent telephone interests. Mr. Strickland, president of the Street Railway, Electric Light & Gas Association of Texas, extended an invitation to the company to consolidate with their organization. The fact that the Bell Telephone Company is entitled to membership in the said organization was considered sufficient reason for the independent people to maintain a separate association.

Committees on credentials, constitution and by-laws and permanent organization were appointed by the chair, with instructions to report as soon as possible. The committee retired and while preparing reports a very interesting address was given by Mr. W. J. Maroney. The report of committees was then read and adopted.

The association then took up general business and a very enthusiastic meeting resulted. It was found that there were represented at the meeting over 14,000 miles of toll line and more than 12,000 independent telephones.

The meeting adjourned after having passed a motion to hold the next meeting at Fort Worth within 60 days; the exact date to be fixed by the executive committee of the association. The executive committee was authorized by the association to prepare a map of the independent lines throughout the State and secure data as to the number of telephones in operation.

After adjournment of the meeting, the various members were entertained by representatives of manufacturers located at Dallas. Following a dinner at the Oriental Hotel, the members in a body attended the Opera House and later on, through the courtesy of C. W. Hobson, of the Duncan-Hobson Electric Company, were entertained at the Elks Club.

Another Monument to Joseph Henry.

It is announced from Albany N. Y., that a movement has been started to honor one of the most famous natives of the city and State by the erection of a memorial statue at the eastern end of the Capitol Building. Joseph Henry, who was identified with the invention of the electromagnetic telegraph, was a pioneer in important lines of electrical research, and the head of the Smithsonian Institution, was born in Albany on December 17, 1797. One of the decorative features of the Electricity Building in St. Louis last year was a statue of that distinguished man, modeled in staff. Through the efforts of Martin H. Glynn, commissioner from this State at the Louisiana Purchase Exposition, the statue has been secured for the Albany Institute Historical and Art Society, and the Legislature will be asked to show its appreciation of Joseph Henry's worth and service to civilization by providing for its reproduction in bronze.

It is proposed to place this monument of the inventor of the first form of electromagnetic telegraph in one of the most conspicuous places in the city. The statue, designed by Flanigan, represents Henry as he appeared in 1830, two years before his removal to Princeton, where he was a professor in the college, and sixteen years before his election as secretary of the Smithsonian Institution in Washington, a post he held until his death, in 1878. It was while he was a teacher in the Albany Institute that his historic electrical and telegraphic experiments were conducted. A statue of Henry has an appropriate place in front of the Smithsonian Institution at Washington.

Death of Edward Hemphill Mullin.

It was with profound regret that we recorded last week as we went to press the sudden death of Mr. E. H. Mullin, the well-known technical journalist, who succumbed to an acute attack of heart disease while sitting quietly at home reading, at Milburn, N. J., during the snowstorm on Wednesday afternoon, January 25. Mr. Mullin had been away from his office in New York for four or five days with a rather bad attack of grip, but had been hoping to resume work daily; and in fact said so in a telephonic communication with the offices of the ELECTRICAL WORLD AND ENGINEER on Tuesday. While there was known to be an organic weakness of the heart, Mr. Mullin's general health and physique were such as to promise him a much longer span of life than 45 years.

Mr. Mullin was born at Castlederg, County Tyrone, Ireland, in 1859, and received a broad and liberal education, graduating with honors in 1881 from Queen's College, Belfast, where he took special interest in physics, and studied medicine afterward in London. His tastes were always toward literature, however, and soon after his arrival in this country he became interested in newspaper work. Of a most wide and diversified culture, quick-witted, warm-hearted, ready with word and pen, and with an Irishman's love of a fight, he soon became one of the conspicuous and successful members of the staff in which the late Charles A. Dana took so much pride; and it was always a matter of deserved self-congratulation with Mr. Mullin that he had been one of the *Sun* men in its palmiest Dana days. His ability led to his appointment as editor of the *Evening Sun*, a position which he filled with marked skill. He also had charge for a time of the technical reporting on the New York *Times*. As a matter of fact, however, he did not take particular delight in strenuous news

THE LATE E. H. MULLIN.

gathering, which seemed to him generally unliterary and often a sad waste of time over trifles; and in this manner he drifted more directly into the field of technical journalism, which enabled him to gratify not less his gift of forcible and felicitous expression than his passionate love for real facts and true statements. Several years ago—in 1898—his work done in this field attracted the attention of President Coffin, of the General Electric Company, and Mr. Mullin was made head of the company's bureau of publicity in this city, a task to which he brought a high conscientiousness, unflagging zeal and a diplomatic talent that in any walk of life would have won public recognition. While perhaps Mr. Mullin would have scorned the title of lobbyist and might have disliked even that of parliamentary agent, it was in the discharge of such delicate and critical duties that he now distinguished himself, rather than in the mere preparation of articles descriptive of a plant or a new piece of apparatus. Every great corporation in these times has affairs and situations when it becomes the subject of misstatement and misunderstanding, and when it requires that some one enjoying the confidence of the newspapers and of the public should make it his business to set forth the things as they are and see that at least both sides are given a hearing. The work that Mr. Mullin thus did and in other ways as a bureau of intelligence has probably never been surpassed in this country. Aside from this, Mr. Mullin took the keenest interest in the welfare of technical journalism, not merely as a business enterprise, but as an arena of keen intellectual effort, and it is not saying too much to include him among the potent influences which during the last ten or fifteen years have so perceptibly raised the general standard in this field. In all things he thought as straight as he talked.

As already intimated, Mr. Mullin was warmly and genuinely human, and his sympathies were large enough to need many objects to play over. He was for many years an active member of the American Institute of Electrical Engineers, was a member of the council at the time of his death, as well as a member of its finance committee. He was also a member of the New York Electrical Society and one of its vice-presidents; and a week before his death he had been elected vice-president of the American Advertisers' Association, a powerful body, representing the interests of the largest advertisers in the United States. Mr. Mullin was also active in work connected with the Association of Edison Illuminating Companies and the National Electric Light Association, while there were few conventions of other technical bodies which he did not attend during the year. His acquaintance among professional and technical men was thus of the widest, and yet there were few with whom he could not find himself *en rapport*. He was a frank controversialist, whose sincerity nearly always disarmed the opponent. He loved a good story and could always tell a better. He had a marvelous memory for political events and personalia, and during his residence in America acquired an acquaintance with the facts of record as well as the forces beneath the surface in public life and affairs that was simply prodigious. He was an omniverous reader, not simply of light fiction—a volume of which was almost always to be found in his overcoat pocket—but of all the latest biographical and scientific books. These he not only loved to discuss with his friends, but to criticise, and in this manner he had become one of the most acceptable reviewers of the day, contributing alike to periodicals on this side of the water and in England. His literary judgment was, if anything, finer and saner than his social, as there he allowed less play to his warm human hates and loves, and dealt with his subject coldly and keenly as a work of art or as an abstract principle in science. Although of somewhat brooding temperament, favorable to the absorption and creation of literary ideals, Mr. Mullin was driven by the ardor of his disposition into the most incessant participation in affairs, so that undoubtedly the very fullness of his life led to its untimely abridgment. It should be added that he was a member of the Engineers', Lotos and Transportation Clubs. One item of his service to the Institute that must not be overlooked was his management of traveling plans and facilities for its conventions. Thus last year, on the occasion of the International Electrical Congress, and the visit of so many engineers from abroad, he organized and handled for the Institute the special train to St. Louis, making the circuit of the country. Before the British Institution of Electrical Engineers left for home, it showed its appreciation of such work by presenting Mr. and Mrs. Mullin with a handsome silver service.

Last Saturday a number of personal friends and intimates gathered at the house at Milburn, N. J., to share with his widow and relatives in the last sad rites and funeral exercises. The American Institute of Electrical Engineers was represented by the president, Mr. John W. Lieb, Jr., and the New York Electrical Society by Secretary G. H. Guy. There was also a large gathering of officials from the General Electric Company, the Institute, Masonic lodges and other organizations. Among these may be mentioned Messrs. R. W. Pope, Calvin W. Rice, Prof. G. F. Sever, John J. Carty, George A. Hamilton, Townsend Wolcott, John McGhie, H. W. Blake, T. R. Taltavall, S. W. Goddard, F. C. Bates, T. E. Crossman, T. Beran, H. C. Judson, L. R. Pomeroy.

Independent Telephony in Indiana.

In an interview printed in the New York *Herald*, Mr. S. P. Sheerin, of Indianapolis, president of the New Long-Distance Telephone Company, and of the Indianapolis Telephone Company, gave an account of the independent telephone movement in Indiana. When the independent long-distance and local Indianapolis companies were organized in 1898, the Bell company had in Indianapolis 2,100 telephones and in the State of Indiana, including Indianapolis, about 6,700 telephones. It charged $72 a year for an unlimited business service and $54 for residence service. The independent company made a rate of $40 for business and $24 for resi-

dence service, and these are the present rates. Recently the Bell company reduced its rates to those of the independent companies.

The independent companies have now in the State 166,000 telephones, 10,000 of which are in the city of Indianapolis, while the Bell interest claims only 20,000 telephones in the State at present, with about 6,500 in the city. In Indianapolis there are only about 1,600 subscribers who have both services. The independent companies are practically owned locally, the capital invested by persons outside the State not exceeding 5 per cent. of the whole. The Long-Distance Company is paying a 4 per cent. dividend and the Indianapolis company a 6 per cent. dividend. When the independents began operations not a farmer in Indiana had a telephone in his home, and now there are 30,000 farm telephone stations.

The January Meeting of the American Institute of Electrical Engineers.

The January meeting of the American Institute of Electrical Engineers was held at Carnegie Hall, New York, on the evening of January 27. After calling the meeting to order, President Lieb announced the death on Wednesday evening of Mr. E. H. Mullin, who was one of the Board of Directors of the Institute. In making the announcement, President Lieb said that Mr. Mullin was one who had taken a very active part in the affairs of the Institute and that the Board of Directors felt that in his death the Institute has sustained a severe loss—the loss of a member who was in every sense a worker and had the welfare of the Institute at heart. His death was a great shock to his many personal friends, who, in working with him in advancing the affairs of the Institute, had ample opportunity to appreciate in full his many noble qualities of heart and mind. He stated that the Board of Directors at the meeting in the afternoon had passed a resolution providing for the drawing up of a set of resolutions, and that the board would participate on the following day in the funeral exercises and had arranged for a suitable floral tribute to be sent to his home. The secretary announced also the death of Mr. C. N. Wilkes, of Philadelphia, a member of the Institute, who was associated with Mr. D. H. Burnham, the architect.

At the meeting of the Board of Directors held in the afternoon 53 associates were elected. Two papers were presented at the meeting. Of these one by Mr. J. E. Noeggerath entitled "Acyclic (Homopolar) Dynamo," described an apparatus of the unipolar type recently designed at the works of the General Electric Company. The paper also discussed the fundamental principles of this type of machine. The other paper, presented by Mr. J. C. Moultrop, was entitled "Modern Central Station Design as Exemplified by the New Turbo-Generator Station of the Edison Electric Illuminating Company, of Boston. Both of these papers are printed in abstract elsewhere in this issue, together with the following discussion.

By Trolley Up Mont Blanc.

A company has been formed in Paris for the construction of an electric railway, which is to take passengers to the top of Mont Blanc. The projected line will end at the Aiguilles du Gouter, 14,430 ft. above the level of the sea, and as the work has been officially declared of urgent public utility, the construction of the line will begin in a few months. The Jungfrau line, which is nearly completed, arrives at an altitude of 12,498 ft. over the level of the sea, but has the disadvantage of running mostly through tunnels. The Mont Blanc Railway, on the contrary, will have only one tunnel, and the passengers will be enabled to enjoy the magnificent views of the Alps.

The new railway will start at the Fayet, on the Paris-Lyons-Mediterranean line, at the 1,500-ft. level, and will have nine stations where the passengers will be allowed to stop and enjoy the scenery. M. Duportal, the official engineer of the French Government, in cooperation with several other engineers, has made plans for obtaining the necessary electrical energy from some of the numerous waterfalls to be found in the locality.

The cost of the whole line, which will have a length of 20 kilometers, will be about $2,000,000, which has all been subscribed. It is calculated that about 90,000 tourists go every year to Chamounix to try the ascent, and that instead of paying $60 for the services of guides they will be glad to make the ascent by railroad at the cost of only $10 each

Magnetic Survey of the North Pacific Ocean.

A project for a magnetic survey of the North Pacific Ocean by the Department of International Research in Terrestrial Magnetism has been favorably acted upon by the Executive Committee of the Carnegie Institution of Washington and authorization has been given to begin the work this year. An initial allotment of $20,000 has been made to cover the expenses for the current year.

The state of our knowledge of the distribution of the magnetic forces over the greater portion of the earth—the oceanic areas—owing to the paucity of precise data, is exceedingly unsatisfactory. This fact is especially true for that great body of water—the Pacific Ocean—rapidly developing in great commercial importance. Captain Creak, for many years superintendent of the Compass Department of the British Admiralty, now retired, says: "The North Pacific Ocean is, with the exception of the voyage of the *Challenger*, nearly a blank as regards magnetic observations, and I therefore think the magnetic survey proposed will be of great value."

The matter of prime consideration in magnetic work at sea is the elimination of the effects resulting from the ship's own magnetism as due to her construction and equipment. Such effects are especially troublesome to eliminate when it is proposed to obtain not only the magnetic declination at sea, but also the other magnetic elements (the dip and the intensity of the magnetic force). The plan, therefore, to be attempted this year, as worked out by Mr. G. W. Littlehales, hydrographic engineer of the United States Hydrographic Office, and consulting hydrographer of the Department of Terrestrial Magnetism of the Carnegie Institution, is in brief as follows: To charter a wood-built, non-magnetic sailing vessel of about 600 tons displacement, which starting out in summer from San Francisco shall pursue a clockwise spiral course embracing the entire North Pacific Ocean. The object of planning such a course is to gain continuous advantage throughout the survey of the dynamical agencies of the atmosphere and the ocean, in passing in succession into each of the five degree quadrangles into which the chart is divided and in which observed values of the three magnetic elements need to be obtained.

The seasonal shifting of the present centers of barometric pressure will cause a variation from month to month of the conditions of wind and current that are represented on this particular chart, but if the departure from San Francisco be taken in the summer the chain of meteorological events will contribute toward the maximum progress over the course passing thence along the west coast of America to the vicinity of the Galapagos Islands, thence across the Pacific in latitude between 2 and 3° N., thence along the eastern side of the Philippine Archipelago and the Empire of Japan, thence eastward in about latitude 52° N., thence to the latitude of San Francisco, and thence continuing through the series of areas, bounded by parallels of latitude and meridians of longitude each five degrees apart, lying next on the mid-ocean side of the circuit last made, and proceeding gradually and by successive circuits into the central region of the North Pacific.

The total length of the course marked out is about 70,000 knots. Each of the first circuits practically close at San Francisco, so that if it is found that the method pursued is not the best the work can readily be terminated or modified. The entire work of observation and reduction can probably be accomplished in three years. Counting eight months of continuous service per annum, the total annual outlay is estimated at about $12,000. The plan adopted permits of useful comprehensive results being immediately obtained, and is one which can be interrupted without any important waste of antecedent expense, whenever circumstances may render a discontinuance or a modification of the original plan advisable.

Continuous records of magnetic variations required for furnishing the necessary corrections to be applied to the observed magnetic elements in order to reduce them to a common epoch, will be available from the following stations: Sitka, Mexico, Honolulu, Manila, Shanghai, Tokio. In addition there may be soon a magnetic observatory in California or vicinity for lending effective co-operation, and it is hoped the German Government will continue its magnetic observatory at Apia throughout the period of the survey. Also excellent opportunities for controlling instrumental constants and obtaining required additional data will be afforded by stations on the coasts and on islands.

The plan of the courses as mapped permits ready adjustment of the observed quantities for closed areas, in accordance with the

potential hypothesis, and it may even permit to a certain degree the testing of the accuracy of this assumption, though as regards the latter more can be said at the end of a year's work.

While it is not anticipated that any marked irregularities in the distribution of the earth's magnetism will manifest themselves over the deep waters of the Pacific, it is confidently expected that in the neighborhood of the islands and along the coasts distortions and irregularities will be revealed. With the aid of the results of the detailed magnetic survey of the United States and Alaska, opportunity will, therefore, be afforded of studying the effect of the configuration of land and water upon the distribution of the magnetic forces. The first circuit, passing as it does along the American and Asiatic coasts, will yield especially interesting results in this respect. Thus, for example, along the Aleutian Islands, marked local disturbances will be disclosed, as reports are received frequently from mariners in this region regarding the unsatisfactory behavior of the compass.

Telephonic Conditions in France.

There has been very serious dissatisfaction with the conditions of government telephony in France, and an Association of Telephone Subscribers has been formed. It has a growing membership, including between 4,000 and 5,000 of the Paris telephone subscribers. Since July a monthly bulletin has been published by it containing articles and reports on the various aspects of the telephone question in France. With a view to acquiring thorough information on the technical side of the telephone service, the association recently retained Mr. Herbert L. Webb, of London, and formerly of New York, as consulting engineer. That well-known expert has furnished the association with a report on the general conditions of a modern telephone system and with a further report on the principal causes of the defective service in Paris. Mr. Webb's first report contains a well-written popular description of the central battery system, as at present employed in the most modern exchanges. As Mr. Webb has not been allowed to visit the exchanges, his second report is based on general knowledge of the Paris telephone service acquired from public descriptions and from observations made on visits to Paris during the past few years. He divides telephone exchange working into three periods. During the first period, from 1880 to 1890 or 1892, the methods in use were largely experimental. During the second period of another five or six years, the development of telephonic apparatus was more scientific, while during the last period effective methods and apparatus have been perfected and standardized. The Paris system has largely remained in the first period, having only adopted some improvements belonging to the second period mentioned, and being "entirely innocent" of the apparatus and methods of the third period dating from 1897. While these older methods may still be suitable for small exchanges, they should not be applied to larger systems, and, moreover, owing to the defective working of antiquated apparatus, the nerves of the operators are so taxed that it is unreasonable to expect a high standard of efficiency and discipline from these ladies.

Mr. Webb next criticises the peculiar practice of the French Telephone Department in compelling each subscriber to supply his own telephone set, with the result that there are various types in existence, some having radical technical defects. The variety of instruments also makes it impossible to train a force of inspectors to familiarity with the peculiarities of all the numerous types. A further evil is the extensive use of primary batteries instead of magnetos or a central battery for signaling. The cure suggested is the reconstruction of the whole system on modern lines, which would occupy two or three years. Mr. Webb does not give an actual estimate of the cost of this conversion, but is of opinion that it would be "far less than the cost of a single battleship, and even less than the cost of an armored cruiser, and well worth the price." In Paris the total number of telephones is about 45,000, and there is a yearly increase of about 3,600 subscribers. In New York, which has a somewhat smaller population than Paris, there is a telephone system serving over 150,000 telephones and increasing at the rate of 30,000 per year. The flat rate of charging in Paris should be abolished, says Mr. Webb, and with a scientifically arranged message-rate tariff he thinks it would be possible to reduce the minimum basis charge to $30 per annum. If this were done, he concludes, and an active business policy were adopted, Paris would have in five years 150,000 telephones, and in 10 years 250,000 or 300,000 telephones.

Annual Convention of the Independent Telephone Association of Wisconsin.

The annual convention of the Independent Telephone Association of Wisconsin was held at the Hotel Pfister, Milwaukee, January 25 and 26. Besides routine business and general discussions of subjects of interest in the independent telephone field, the most important actions of the convention were the appointment of a legislative committee to get before the legislature a bill governing the price of telephone rentals, and the decision to affiliate with the newly organized National Interstate Telephone Association.

The first meeting was called to order by President Richard Valentine at 2 P. M. Wednesday. In his opening address, President Valentine stated that the association had met a month earlier than usual, because of the necessity of getting before the legislature the bill regulating rates for telephone rentals, which had been lost by one vote in the Senate two years ago. At that time the bill was introduced on the last day for the introduction of new business, and, was no doubt lost because the members of the legislature did not have time to understand it thoroughly. . Turning to the development of the independent telephone field in Wisconsin during the last year, President Valentine stated that there had been incorporated 32 companies, representing a capital stock of $264,340. These were largely rural companies or exchanges in the smaller towns. The only exchange of any size being constructed was that at Green Bay, which was capitalized at $250,000. This company was putting in five miles of underground work. It intends to build exchanges in Marinette, Oconta, Chippewa Falls, and would probably run lines to Oshkosh and Fon du Lac. During the last five years the Bell Company had been attempting to make toll line contracts with independent companies. He spoke of the methods of the Bell Company in frightening the companies into making such contracts. He could not understand why an independent company should make a contract with the Bell Company. They did not seem to take into consideration the fact that by so doing they were injuring every other independent plant in the field. If the independent people tied themselves to the Bell there was no incentive for the construction of independent toll lines.

At the conclusion of his address, President Valentine called upon J. C. Harper, of Madison, to discuss the bill which was to be presented to the legislature. Mr. Harper stated the opposition encountered to the bill was that of attorneys of Madison and Milwaukee employed by the Bell Company. He then read the bill which provides that no individual or company may charge "in one city or village a greater or lesser rental for exchange telephone service than he or it charges in any other city or village of the same class." Another section divides the cities of the State into eighteen classes, according to their population the first class consisting of cities of over 100,000 inhabitants. The bill also provides that the rate charged in the city of a lower class shall never be greater than that charged in one belonging to a higher class. An emergency clause is also added.

Mr. Harper discussed at some length the necessity for such a bill. When the Bell Company was given a charter to do business in the State it was naturally supposed that it would treat all the people of the State alike. Since the independent movement was inaugurated, however, they had reduced their rates in some cities to almost nothing in order to fight the independent development. The expense of the non-paying exchanges was borne by the subscribers in those towns where the independent movement had never been inaugurated.

The cause in the bill providing that the smaller cities should not have a greater charge than the larger ones was inserted because of the well-known fact that the larger the exchange the greater is the cost per telephone to operate it. As an illustration of the difference in rates charged by the Bell Company in different cities, he said the Bell rates in Oshkosh were almost three times as great as they were in La Crosse, although the cities were practically the same size.

President Valentine said there was an erroneous impression with some that the bill made rates, and explained that it did not do so, but that it simply prevented discrimination in rates for equal services.

Mr. Slater, of Beloit, gave his reason for the eagerness of the Bell Company to obtain toll line connections with the independent lines. It did not particularly care for the business obtained from the exchanges, but it wanted to keep opposition out of Milwaukee. By

enabling Milwaukee business men to obtain connections with their customers in the small towns the dangers of an independent system in Milwaukee was lessened.

G. W. Wilder, of Cambridge, wanted to know what was the likelihood of an independent exchange being established in Milwaukee. President Valentine stated there was no immediate hope, and that the people of Milwaukee seemed willing to pay three prices for a telephone.

Mr. Slater stated he was informed that the maximum business rate in Milwaukee was $10 per month, while the minimum rate was $3, and was for a party residence line.

J. J. Nate, of the Stromberg-Carlson Company, was introduced to the convention by President Valentine as one well posted in regard to Bell contracts. Mr. Nate said the Bell Company, after making toll line contracts, collected from the independent people what would represent practically operating expenses if the independent people themselves owned the toll lines.

As the members of the original legislative committee were not present, at the suggestion of J. C. Kuoni, of Sauk City, a new one was appointed by the chair. Those named were Mr. Kuoni, J. C. Harper, of the Dane County Telephone Company; J. M. Baer, of the Fox River Valley Company; Philip Sheridan, of the Valley Telephone Company,and E. A. Miller of the Central Wisconsin Company. President Valentine who was also made a member of the committee, stated that if the bill passed, copies of it would be sent to the legislatures of other States and its passage urged.

Mr. Davenport, one of the original promoters of the Green Bay Company, told of the work in that city. After 27 months of work a franchise was secured last fall. At present 150 men were at work on the construction of the system, which would have a capacity for 3,000 telephones. Mr. Baer said that when he visited Green Bay about a week previous they were using steam to thaw the ground in digging trenches for the conduits, and that the cement was kept from freezing until it set by inserting steam pipes.

Before adjournment, Mr. Harper made a motion that a committee on resolutions be appointed.. The motion having been passed the chair appointed Mr. Wilder, Mr. Alfred Slater, of the Beloit Telephone Company, and Mr. D. L. Bester, of the Mazomanie Telephone Company. No further business being presented, the meeting was adjourned until the following morning.

The second meeting of the convention was called at 11.08 o'clock Thursday morning. President Valentine announced that Mr. J. B. Hoge, president of the National Independent Telephone Association, would address the assembly.. Mr. Hoge, after giving a brief history of the development of the telephone industry, spoke of the rapid growth of the independent movement. At the present time there were 2,500,000 telephones in the independent systems, while the Bell, he alleged, claimed but 1,600,000. Mr. Hoge dwelt considerably on the development of independent long-distance lines. The independent lines between Pittsburg and Kansas City had agreed upon a working basis, and now lines were operating between Topeka, Kansas and Indianapolis, and between Indianapolis and Pittsburg. A line of No. 8 wire would soon be completed between Pittsburg and Baltimore.

Concerning the Bell Company licensing independent companies, he said the Central Union Company had eight men constantly in Ohio who went around trying to induce the independent companies to join the Bell. So far, however, they had made no headway.

Mr. Hoge gave the facts concerning the recent organization of the National Interstate Telephone Association. He said:

"The National Association which has been in existence now for some years, and which was in a measure reorganized last September at the St. Louis meeting, was consolidated last Saturday with the Interstate Association. At the Interstate Association meeting at Chicago a month ago they appointed a committee consisting of five gentlemen, to take up the matter of consolidation with the National Association. That committee met at Indianapolis last Saturday, and agreed upon this sort of a consolidation. The new association is called the National Interstate Telephone Association. The same is to be run by a committee consisting of the five appointed by the National, until the next meeting, which is called for Chicago on June 7 and 8.

"The by-laws and constitution that were adopted provide for organization on the basis of the States and districts, the plan being to reorganize each State in the Union and have it associated with the new association, and the delegation hereafter, or representation, to the National Interstate Association, to be on a basis of one delegate for each 10,000 units, a unit to consist of one telephone or one circuit mile of toll line, and they would be elected by your State conventions.

"Pennsylvania and New York State have organized and instructed their officers to join this association. Ohio has its meeting on the 30th of March, Indiana will have its meeting at no far distant date; Michigan meets either the latter part of next month or in March, and I am assured that Maryland, New Jersey, Virginia, West Virginia and other States in that section will organize in the very near future. The Pacific Coast is figuring on forming an organization to take care of all the Pacific Coast States, to meet probably in Los Angeles. . They will have, say, some three or four districts in that organization. Texas is about to organize. So, briefly, that is the situation on the national interstate organization."

He then took up the question of the adoption of a standard sign for independent companies, and urged that independent companies act together and decide upon a sign that would be uniform the country over, recommending the one adopted by the National Association at St. Louis last summer. The sign was made in the shape of a shield, and covered with red and white bars. Blue was also a prominent color. The sign bears the words "Independent Local and Long-Distance Telephone," and is made of enamel. A motion made by the chair that the sign be adopted was unanimously carried.

Mr. H. A. Nuttall, of Chicago, then gave a talk on the methods pursued by the Bell Company in dealing with the independent companies. To give appearance of truth to their assertion that they would put in a competing exchange if desired contracts were not made, switchboard, cables and wires had sometimes been shipped by the Bell Company to the town where the independent line was being operated. When the independent operator saw these on the ground he often made the desired contract.

"Simultaneous Telegraphy and Telephony" was the subject of a paper given by Dr. George Walker Wilder, Professor of Telephony at Armour Institute, Chicago. He stated that it was much easier to telegraph over telephone wires than it was to telephone over telegraph lines, since the latter usually had ground returns. It was a comparatively easy matter to put a telegraph instrument on a telephone line. The currents due to the telephone instrument were prevented from affecting the telegraph apparatus by the insertion of choke coils. Condensers prevented the current for the telegraph instruments entering the telephone apparatus. Experiments in using telegraph lines for telephone instruments were being carried on by several railway companies. He thought the revenue from toll lines could often be increased either by leasing them for telegraph purposes, or by operating telegraph service upon them in addition to the regular service.

Mr. Hoge stated that his company in Ohio were operating a number of leased wires with no serious difficulty. The business principally done was by the Associated Press and by brokers.

At the conclusion of the discussion on Dr. Wilder's paper, the chair appointed a nominating committee consisting of J. C. Harper, Charles Schernecker, of the Interurban Telephone Company, and W. Van Meddlesworth, of the Citizens Telephone Company, of Racine.

Regarding the affiliation with the National Interstate Telephone Association, President Valentine said that while there was nothing in particular now that the National Interstate Association was working on he felt that every State association should be affiliated. Mr. Hoge stated that the plan of the association was simply to get the country thoroughly cemented together. Then any subjects such as legislation would receive united support. A committee, consisting of Messrs. H. C. Winter, of Madison; J. C. Murdoch, of Brodhead, and W. F. Goodrich, of La Crosse, was appointed to confer with Mr. Hoge in regard to affiliation. The meeting was then adjourned until afternoon.

The last session of the convention was called at 3.45 P. M. The committee appointed to confer with Mr. Hoge reported that it had examined the plan of the National Interstate Association, and believed that it was desirable for the Wisconsin Association to affiliate with it. The committee recommended that membership be applied for and suggested that President Valentine be elected as a member of the advisory committee. On a motion by Mr. Baer the report of the committee was adopted.

The report of the secretary-treasurer stated that the association had grown from a membership of 18 in 1900, when it was organized,

to 64 active and 29 associate members at the present time.

A letter from the Citizens Business League, of Milwaukee, extending an invitation to the association to hold its next annual meeting in Milwaukee, was read, and placed on file.

The report of the nominating committee was then heard. This named Mr. Richard Valentine, of Janesville, for president, Mr. J. C. Kuoni, of Sauk City, for vice-president and Mr. H. C. Winter, of Madison, for secretary-treasurer. For the executive committee the following gentlemen were selected: Messrs. W. van Meddelsworth, of Racine; Philip Sheridan, of Green Bay; J. C. Harper, of Madison; W. F. Goodrich, of La Crosse; H. W. Bartlett, of Chippewa Falls; John M. Baer, of Appleton; E. A. Miller, of Hixton, and J. C. Crawley, of Superior. A motion to adopt the report of the nominating committee was carried unanimously.

After some discussion it was decided to hold the next annual meeting at Milwaukee on the third Wednesday and Thursday of December, 1905, these dates being December 20 and 21.

Mr. W. F. Goodrich, of Lacrosse, and Mr. J. C. Harper were elected to serve with President Valentine as delegates to the National Association convention to be held at Chicago in June. Prof. George W. Wilder, Mr. Philip Sheridan and Mr. Charles Schernecker were selected as alternates.

The convention was then adjourned.

American Telephone Statistics—III.

THE last two issues of this journal have presented the chief figures compiled by the United States Bureau of the Census and furnished in its recent bulletin on the telephone and telegraph systems of the country. These statistics already cited for the two industries as they stood at the close of the year 1902, gave capital, income, expenses, dividends, general data of equipment and other essential details. A few further figures of interest may now be quoted as to some of the main divisions of telephonic work.

A great deal of new construction was brought to account in the returns, showing general activity all over the country, in the telephonic field. In some systems an exact separation was not made of the expenditures for repairs, renewals and extensions, but the $51,903,021 may be accepted as a close approximation of the amount expended for new construction and equipment. Of this amount $7,566,365, or 14.6 per cent., was expended by the systems of New York State, and $6,114,696, or 11.7 per cent., by those of Pennsylvania. In Illinois $4,472,060 was expended. Ohio, Missouri, New Jersey and Massachusetts each reported over $2,000,000 added in new construction and Iowa, Indiana, California, Minnesota, Michigan, Kentucky and Texas each reported over $1,000,000.

The next important item noted is that of employees. The average number reported for all commercial and mutual systems, including the salaried officials, superintendents, clerks, operators and employees required on the line, and other equipment, amounted to 78,752. Practically all of these were employed by the commercial companies. A large number of the mutual companies reported that the service was not sufficient to give constant employment to anyone, practically all of the repair work being done by the patrons.

Of the total number, 14,124, or 17.9 per cent., were salaried officials, general superintendents and clerks, and 64,628, or 82.1 per cent., were wage earners. The salaries and wages paid during the entire year amounted to $36,255,621, of which the salaries formed $9,885,886, or 27.3 per cent., and the wages $26,369,735, or 72.7 per cent.

In many instances one employee—reported sometimes as an exchange manager, sometimes as a lineman—is engaged at a specified annual compensation to care for an entire exchange, keep the line in repair, and perform all duties incident to its operation; no operators are reported, as his family attend to the switchboard. This practice is followed in many mutual systems, and is in use also in some small commercial companies. In the smaller systems the same employee performs the duties of a foreman, inspector, lineman, wireman, batteryman and troubleman—in fact, attends to the entire plant. These points must be borne in mind in dealing with the figures quoted.

Data have already been quoted as to the physical equipment of the telephone systems, and further detailed figures are given in the accompanying table.

ALL SYSTEMS, PHYSICAL EQUIPMENT: 1902.

Number of systems	4,151
Switchboards, total number	10,896
Manual:	
Common battery	837
Magneto	10,005
Automatic	54
Total capacity of switchboards	2,447,403
Engines, horse-power	2,750.5
Dynamos, horse-power	5,459.1
Electric motors, horse-power	4,209.8
Auxiliary cross-connection boards, etc.	9,255
Magneto generators, ringers, etc., in exchanges	14,931
Batteries	
Primary, number of cells	110,648
Storage, number of cells	19,001
Stations or telephones, total number	2,315,297
Total miles of wire	4,850,486
Underground construction:	
Miles of duct	16,474.9
Miles of cable	7,290.6
Miles of wire	1,690,502
Overhead construction:	
Miles of single wire	2,369,914
Miles of cable	8,104.5
Circuit miles of wire in cable	780,530
Submarine:	
Miles of cable	262.6
Circuit miles of wire in cable	9,540

The above table shows the physical equipment upon which the telephone service of the United States depended at the time of the report. The 5,070,554,553 messages or talks, and the $86,825,536 of revenue derived from the service, evidenced the efficiency with which this equipment was operated. The number of switchboards of all kinds—10,896, exceeded the number of public exchanges (which numbered 10,361) by 535. This excess of switchboards is caused, to some extent, by the separate enumeration of a toll or long-distance switchboard and a local board in the same exchange. The magneto switchboards were numerically those most generally used, the 10,005 reported for this class forming 91.8 per cent. of the total. The greatest number of common battery or central energy switchboards were in use in the State of Pennsylvania, which reported 118, or 14.1 per cent. of all boards of this class. The largest number of automatic switchboards was reported from Kansas, where 16, or 29.6 per cent. of all automatic boards, were in use. The total capacity of the switchboards was 2,447,403 drops, or an average of 225 for each board, as compared with an average of 200 subscribers, 212 telephones, and 445 miles of wire.

The telephone systems reported 196 engines, a total of 2,750.5 hp; 1,359 dynamos, with 5,459.1 hp, and 1,414 electric motors, with 4,209.8 hp. Included in the 196 engines were a few gas engines, and with the electric motors are included a few water motors. Electric dynamotors (rotary converters) and motor dynamotors (motor-generators) were reported indiscriminately as dynamos or as electric motors, rendering it difficult to classify exactly the apparatus enumerated.

Of the 4,850,486 miles of wire, 2,369,914, or 48.9 per cent., consisted of wire above ground, and 1,690,502, or 34.8 per cent., of wire underground. The remainder consisted of 790,070 circuit miles of wire in overhead or submarine cables. There were, on the average, 231.9 miles of wire in each mile of underground cable, making an average of 116 pairs of wires per cable. The largest amount of underground construction was in New York State, which reported 2,130 miles of duct, 1,571.7 miles of cable and 392,973 miles of single wire; but Pennsylvania had more duct than New York by 1,988.4 miles. In wire mileage Pennsylvania was second, with 249,246; Ohio third, with 153,677, and Massachusetts fourth, with 148,707. There were eight States and Territories which did not report any underground construction.

Of the overhead wire mileage, 2,369,914 miles, or 75.2 per cent., was single wire on pole or roof line, and 780,530 miles, or 24.8 per cent., was in overhead cable. The total length of overhead cable was 8,104.5 miles, so that the average wire mileage per mile of cable was 96.3 miles, making an average of 48 pairs of wires per cable. In miles of wire in overhead cable, Ohio ranked first, with 114,473 miles; New York second, with 82,967 miles; Pennsylvania third, with 73,670 miles, and Illinois fourth, with 71,251 miles.

The total wire mileage in submarine cables was only 9,540 miles. Of this amount 3,267 miles, or 34.2 per cent., was reported from New York State; 1,034 miles, or 10.8 per cent., from Michigan, and 996 miles, or 10.4 per cent., from New Jersey.

The terms public exchange and central office were used in the census as designating the place where wires are interconnected for the use of the public generally, by means of a switchboard. Public branch exchanges and branch central offices having switchboards were also considered and counted as public exchanges or centrals. The 10,361 public exchanges shown represented the entire number of offices in which interconnection is made between subscribers.

The 4,985 independent rural lines from which reports were received did not operate any exchanges or centrals. There were 7,883 private branch exchanges reported, all operated by the commercial systems.

Electrons and Older Freeholds.

Discussing electrical theories of matter in the *Hibbert Journal,* Mr. Newman Howard says: "Long before the Christian Era the atomic theorists of Greece and Rome, from Leucippus to Epicurus and Lucretius, had surmised that matter, seemingly still, was, in reality, in rapid motion. An eternal hail of colorless corpuscles deflected into whirling vortices—how, without divine agency, deflected was not clear—this begot all things, live and dead, so they imagined—these corpuscles being too small for sight, and a-toma, or indivisibles. In place of the seeing gods they enthroned blind chance and hueless matter, immortal as their gods, but how far less picturesque! The last years have seen the dawn of a revolution in science as great as that which in the sphere of religion overthrew the many gods and crowned the One. Matter, as we have understood it, there is none, nor probably anywhere the indivisible atom. The so-called elements are systems of electronic corpuscles, bound together by their mutual forces too firmly for any human contrivance completely to sunder them—alike, nevertheless, in their electric composition, differing only in the rhythms of their motion. Electricity is all things, and all things are electric. Between gray matter and bright electricity we prefer the last; it is vivacious; it loves and hates, flashes, burns, leaps and sleeps—in the tick of your watch it will fly round the earth. Like Ariel, it is quick as thought; nay, perhaps, it is Thought itself—thought which conjures up 'this insubstantial pageant'—'such stuff as dreams are made of,' yet not in the least likely to fade and leave not a wrack behind. It cheats us into the dream of solid substance by whirling in furious battalions, and by its sheer energy holding that space that we once called the atom. A drop of water may contain as many 'atoms' as the world contains drops of water; and if the atom were magnified into a cathedral, each electron would be as a crumb in the cathedral. But those crumbs themselves are probably each a universe with its worlds and its atoms."

Engineering and Commerce.

The following interesting communication from Mr. B. A. Behrend, chief engineer of the Bullock Electric Company, appears in the London *Electrician* as a letter to the editor:

I was engaged in the supervising and directing of a test on an 8,000-hp synchronous motor during the small hours of the day, and having a few minutes to spare I took up the *Electrician* of November 18, in which you reprint Mr. James Swinburne's address to the students of the Institution of Electrical Engineers, entitled, "Some Difficulties in Getting On." The early hour of the day, the strenuous work which had yet to be accomplished by my assistants and myself after we had been working for almost 24 hours continually, all this "unpaid-for" devotion did not harmonize with Mr. Swinburne's advice to the students—to take "a money view of everything." The address began to interest me, and I read it carefully, taking pains to keep it from my assistants for fear that they might take a "money view of the situation" and refuse to stay working in their clothes for another 12 hours needed to finish the tests on this largest of electric motors in the world.

Mr. Swinburne's address is entitled "Some Difficulties in Getting On." If this address were delivered to a heterogeneous class of students, not only of engineering but of law, and of medicine, and of all other branches of human knowledge that can be studied at our colleges, the address might have been very much to the point. It is undoubtedly true that if you want to get on in the world you had better not study engineering or any other scientific pursuit. If Mr. Swinburne objects to the use of the word "scientific," let me say that knowledge is by no means desirable for getting on, and that I hold strongly that the adage attributed to Bacon, that "knowledge is power," requires emphatic qualification.

"Knowledge is power" in the hands of him who can wield it and put it to any use he pleases, but in the hands of most people knowledge is not power, because it controls them, and it is their master while it should be their servant.

When Mr. Swinburne states that "the business man comes out far away above the engineer. He employs the engineer; the scientific man is his servant," Mr. Swinburne is stating merely a matter of fact for which he is in no way responsible. This is a law of the social cosmos against which no amount of railing will avail. This is not due so much to the fact that young men's education nowadays consists more or less in the study of "Aztec Metempiries," it is due to the fact that both the average student and the average teacher are very average men. Education is given to the boy of very average intelligence by a teacher of very average intelligence, and hence the quality of the knowledge and of the teaching is very average, too. So that, even if knowledge *were* power, *that knowledge* which is taught need not be power at all.

Why is it, then, that the engineer is employed by the business man and not vice versa? The reason is obvious to anyone, although he will be better able to appreciate it if he has read and digested Mill's "Political Economy." It is a fact that capital is the mother of all labor, and that the engineer who wishes to market his ability needs capital, and plenty of it, to turn his ability to account. Shops in which machinery of any kind can be built are expensive, and weekly payrolls want to be met, and for all these things the engineer goes to the capitalist, and on account of these things he is the capitalist's servant and the capitalist is his master. This, again, is a fact derived from the laws of Nature for which the engineer is in no way responsible. "To him who hath shall be given," and as the capitalist can wait for years without starving, the engineer, whose only capital is his brains, wants to live, and, therefore, has to make a bargain with the capitalist to accept his services. This law of Nature which has made capital the mother of all labor has placed the engineer where he is to-day. The business man without capital is in no better position than the engineer; on the contrary, his position is less enviable, as good business ability is not so rare as good engineering ability, which statement is proved by the fact which Mr. Swinburne can obtain by a study of the social conditions in the United States, that the business man without capital is paid less than the engineer without capital.

When Mr. Swinburne says that "a man's earnings is a rough test of his value to the world," I fear that Mr. Swinburne is making a statement which he learned in the study of "Aztec Metempiries." Money making is an art just as engineering or medicine is an art. The aim of a great engineer consists in engineering achievement of a high order. The aim of a great surgeon consists in surgical work of a high order. The aim of the money maker consists in making money of a high order. The standard of measure of greatness in the three professions is different, and hence it is illogical to apply the standard of money making to these three professions, as money making is only an incentive to the first two professions, and the aim of the third profession.

When Mr. Swinburne says: "Our leading consulting engineers do not spend a large portion of their lives plotting curves, counting electrons, or even making anything more than arithmetical calculations," I only have to say that—paraphrasing Mr. Swinburne's remark that "electric installation work is merely a sort of electric plumbing"—consulting engineering is mostly jobbing of electric apparatus. The commercial engineer is likely to be neither a first-class engineer nor a first-class money maker. He is average all the way through—average in intellect, average in engineering, average in money making. The money maker of ability will consider him a tyro in money making; the engineer of ability will consider him a tyro in engineering.

Again quoting Mr. Swinburne, he says "the engineer will remain in the middle position as long as he takes the middle view and considers engineering as something superior to money considerations, and as long as he looks down on business and commercial methods." Mr. Swinburne here forgets that as soon as the engineer emerges from the position thus outlined for him, he becomes a business man with an engineer's education. But who is going to do the engineering for him after he has entered into the commercial side of engineering? Somebody has to do the engineering work, and to him Mr. Swinburne's criticism will always apply. I have no patience with that cant which we fortunately do not hear so much of nowadays as we did some 15 years ago, disparaging the commercial side of engineering work. It is necessary just as much as the purely engineering work is, and to whichsoever a man is best fitted, he should devote himself. But it is due to just such addresses as Mr. Swinburne's that engineering work of enormous commercial value is not

duly appreciated by the business man with whom rests the fixing of the compensation for such work. Even engineering work of a very high order is generally underpaid. I do not mean by engineering work of a very high order merely, for instance designing ability; I mean by it exceptional ability in designing apparatus which is commercial, and executive ability to direct the large number of assistants who are always needed in large manufacturing concerns.

The men who get on in the world are never of the common run. It seems to me that the hardships of the successful men who are engaged in professions requiring study and knowledge like engineering, law and medicine, are greater than the struggles of the business man, for the simple reason that the tools of the successful business man consist in capital, which is easily convertible into the commodities of life.

The work of the engineer is very much like that of the soldier. The soldiers in the army are numerous, the officers are few, the generals still fewer. Money is not the aim of the soldier, of the officer, of the general. The officer who fell in the relief of Lucknow would have made more money if he had stayed in Cheapside running a grocery.

There is much good in Mr. Swinburne's address, but much that is apt to misdirect the young man's mind. In positions requiring engineering ability we need engineers and not commercial men, and if a man feels in him that faculty for making money, let him turn his ability into the channels of money making, and not into the channels of engineering. He will be more successful in money making than he will in engineering.

Use of the Telegraph in Warfare.

The use of the telegraph in warfare was discussed by Brig.-Gen. A. W. Greely, chief signal officer of the United States Army, at the annual meeting of the Military Service Institution at Governor's Island, New York Harbor, last week. Gen. Greely's paper was on "Lines of Information," which, he said, in warfare of the future must cover all telegraphic censorship, the general control of mails, the construction, operation and maintenance of telegraph lines, balloons and visual signaling.

The Japanese, he said, have conducted their operations with a skill hitherto unsurpassed in telegraphing and ballooning. Gen. Greely gave the interesting information that not once was Gen. Kuroki under fire in directing his celebrated flanking movement, and that so perfect were his telegraph lines that only once was connection with headquarters lost, and then only for a short time. Gen. Greely quoted Frederick Palmer as saying that the clicking of the telegraph instruments at his headquarters meant more to Kuroki than the sound of the guns.

Gen. Greely then gave a general plan for "wiring" a great army spread out before an enemy. "The army and corps headquarters," he said, "should be connected with the base of operations by permanent trunk lines, which should carry at least two wires and an additional wire for each 10,000 troops. The trunk lines should preferably follow a railroad or the main high roads, thus insuring them from hostile interruption and making it easy to repair them. In a large army the corps on the extreme flanks should be reached direct from the base over separate wires. These lines should be bisected by lateral lines at road junctions, thus insuring alternate routes, a matter of vital importance.

"Telegraph offices should be maintained not more than ten miles apart on trunk lines and five miles on branches. Branch lines should be run from corps headquarters to division brigades and any smaller units occupying important positions. This system should not only be under the control of the chief signal officer, but circuits should be arranged so that the commanding general can be directly connected by wire with any command."

Supplemental to the main system, Gen. Greely said, should be "the flying lines," those laid by advanced detachments on picket or reconnoitering duty by stringing wires on lances or in the shrubbery. There was no reason, he said, why an outpost or reconnoitering body could not always be kept in communication with the main army.

"The changed conditions of modern warfare," he said, "will henceforth involve deeper formations, widely extended fronts and enlarged areas of field operations. These apply to all armies, and their success in campaigns will depend largely on their lines of information."

Electrical Contractors' Association of Wisconsin.

The Electrical Contractors' Association of Wisconsin held their midwinter meeting at the Republican House, Milwaukee, January 17 and 18. It was decided to hold the summer meeting of the association at Oshkosh. The new officers as elected are: President, J. H. Sanders, Oshkosh; vice-president, B. F. Harloff, Madison; secretary, Albert Petermann, Milwaukee; treasurer, George Knoerr, of the Wisconsin Electrical Construction Company, Milwaukee.

Electric Omnibus Line in Italy.

The following interesting description of an electric omnibus line appeared in a recent issue of the *L'Elettricita,* published in Milan, Italy: "We have many times reported in these columns the interesting experiments made by different constructors to develop a practical system of electric traction on ordinary roads; and at the beginning of the year we described in all its particulars the Canton system which gave so much promise. We learn that the Societa Italiana per Industrie Electriche (The Italian Company for Electric Industries), of Spezia, which holds the concession for the electric omnibus service without rails from Spezia to Portovenere, has decided to adopt on this line the jointed trolley system of the firm C. Frigerio & Co., of Milan (which has just assumed the task of making practical application of the Canton system), and has closed a contract with the above-mentioned society for the construction of a suitable plant. The service will be begun with three coaches of an absolutely new type worked out by the Frigerio firm, and of the capacity of 16 persons each.

"The construction of the double line about 16 km long has been intrusted to the Societa Italiana per Trazione Elettrica Ing. Meriggi Diaz & Co., of Milan, specialists in this kind of work. They have, in fact, worked out a new type of suspension with quadruple insulation between the two lines, which will certainly give the best results. The insulation adopted, which, being used on a coast line, must be of a special composition, is that of the Ohio Brass Company, of Mansfield, Ohio, a name on which the greatest reliance may be placed.

"Meanwhile, we observe with pleasure that the first important installation of this kind has been intrusted to two Italian firms, and hence we judge that we shall be able to secure from the results of this great and complex experiment of traction without rails models for future plants of this kind which in Italy are destined to solve a very important problem."

Electrical Engineers of the Times.—V.

PHILIP TORCHIO.

Philip Torchio was born at Vercana, Province of Como, Italy, August 2, 1868. After having received private elementary tuition, he followed the classical courses at the Gymnasium and Lyceum of Como, from 1880 to 1888. In 1888 he went to the University of Pavia,

PHILIP TORCHIO.

where he studied mathematics and physics, graduating in 1890. Upon leaving the University he took up mechanical engineering at the Royal Polytechnic of Milan from 1890 to 1893. During the last year at the Polytechnic he also took the special course of electrical

engineering at the Institute Carlo Erba, a course limited to a small number of students chosen in order of merit from the graduating class of mechanical engineers. In 1893 he obtained the diploma of mechanical engineer, and immediately after came to the United States.

Mr. Torchio's first employment in the United States was with the Sprague Electric Elevator Company as draughtsman and subsequently as chief draughtsman, from November, 1893, to January, 1895. He resigned the latter position to join the engineering department of the Edison Electric Illuminating Company, of New York (now the New York Edison Company), with which company he has remained continuously the past ten years, at present holding the position of electrical engineer.

During his early career with the Edison Company a great opportunity was offered to Mr. Torchio for applying his technical training and analytical methods to the study of central station economics, and of this he fully availed himself, thereby acquiring a wide general and special knowledge and experience relating to technical, operating and commercial problems met with in central station practice. In later years he has been closely identified with the designing, installation and operation of the large high-tension system of the company, and other important works.

Mr. Torchio has read a number of papers on electrical distribution and central station practice before the American Institute of Electrical Engineers and the Association of Edison Illuminating Companies, and presented a paper before the recent St. Louis International Electrical Congress. In the spring of 1903, under the auspices of Prof. F. B. Crocker, he delivered to the graduating class of electrical engineers at Columbia University a course of lectures on central stations. Mr. Torchio is a member of the American Institute of Electrical Engineers and of the Associazione Elettrotecnica Italiana.

CURRENT NEWS AND NOTES.

NEW YORK ELECTRICAL SOCIETY.—The next meeting of the New York Electrical Society will be held Wednesday, February 15. Mr. H. H. Vreeland, president of the New York City Street Railway Company, of New York, will lecture on "The Development of Street Railway Systems." A large attendance is expected.

CURIE RADIUM FOR HOSPITAL.—Prof. Curie, the discoverer of radium, has sent through Count von Khevenhüller-Metsch, the Austrian Ambassador, a tube of radium to the Vienna Hospital for use in the cure of lupus. The gift is a recognition of the act of the Austrian Government in furnishing Prof. Curie with pitchblende for his original researches.

MADISON A. I. E. E. MEETING.—At the January meeting of the Madison branch of the American Institute of Electrical Engineers held Thursday evening, January 26, the subject of "The Maximum Distance to which Power May Be Transmitted Economically" was discussed. Mr. O. O. Wagle, student, abstracted Mr. Mershon's paper and Mr. G. A. Rodenbaeck gave a review of the New York discussion. The meeting was very well attended and much interest was shown in the general discussion.

ELECTRICITY VERSUS GAS.—Finding that many members require data and discussion as to the situation as between electric lighting and gas, the National Electric Light Association has brought out a new and revised edition of Mr. W. F. White's well-known paper on the subject. It contains a large amount of information as to Welsbach lights, and the broad questions of illumination are ably dealt with. The pamphlet runs a length of 41 pages, and members can obtain copies upon application.

OMAHA Y. M. C. A.—In connection with the night school of the Y. M. C. A. at Omaha, Neb., there is being conducted this year an enthusiastic electrical club composed of about 25 young men connected with the various electrical industries of the city. Round-table discussions, visits to the various local electric plants, lectures and talks by prominent local and out-of-town professional men on practical and technical topics in electrical lines, are all found to meet the object of the members in broadening and deepening their knowledge and better fitting them for their everyday occupations.

NEW YORK LIGHTING CONTRACTS.—After getting public light—except in his so-called "investigation"—for a year or two from the public service corporation, Comptroller Grout has set up the audacious claim that there was no contract made. Papers filed by the New York Edison Company with the Corporation Counsel indicate that the lighting companies will claim in the courts that they have had a contract with the city during the interval in which no contract was supposed to have been in existence. The claim is to be based on the fact that the Comptroller's office failed to restore to the companies the certified checks which accompanied the bids, but cashed them in; and also that Commissioner Monroe, who received the bids, never had given formal notice of rejection, but instead repeatedly had notified the companies to set up lamps here and there at indicated points.

LIGHTING AS A MUNICIPAL BUSINESS.—In discussing the question of politics in municipal lighting plants, Mayor Chapin, of Holyoke, Mass., says: "The greatest danger in municipal ownership in this line is from political changes. The lighting business is one of many complications, a manufacturing business in fact that can be carried on successfully only by persons of skill and experience. The difference between success and failure lies in the skill and ability of the men conducting the business. A lighting plant is not like water works, which require little attention comparatively after once installed; it requires study and expert care all the time by men whose minds should not be disturbed with uncertainties about the probable length of their jobs or by participation in politics. An administration of different politics might want to give those places away as political rewards. Such a thing would have a bad effect on the future of the lighting plant. To succeed it must be kept out of politics under a system of management that will insure the employes security in their places during efficiency."

CONTROL OF WATER POWERS is a matter of official study and present investigation. Maine, New York, Pennsylvania, North Carolina and Alabama are among the States which have co-operated with the general Government in measurement of the volume of streams and investigation of their water powers, and Government monographs have thus far been published in the water supply papers on the water powers of New York, Maine, Alabama and the southern Appalachians. The results of these studies in the Eastern States within the past ten years have led to some very interesting conclusions. They show that the possible development of water power in New York is over 1,500,000 gross hp. The figures for Niagara Falls as a whole reach several million horse-power. These measurements include the special investigations of the Hudson River in 1895, the Genesee River in 1896 and Niagara Falls in 1897. The present permanent power in the Genesee River is only 6,727 gross hp, but the construction of the projected reservoir at Portage will increase it to more than 57,000 hp. The Hudson and its tributaries may be made to contribute nearly one-fifth of the water power available for industrial purposes in the State.

A PHOENIX CITY PLANT.—Mayor McClellan, fearful that editor Hearst might "steal his clothes while he was in bathing," has determined to get a city electric light plant going anyhow, and the New York Department of Street Cleaning has advertised for bids for the construction of an incinerator at Delancey Slip, between Tompkins and East Streets. Bids will be received up to noon of February 15. The incinerator is to be a part of the lighting plant under the Williamsburg Bridge. It will consume the refuse collected by the Street Cleaning Department, turning it into power to light the Williamsburg Bridge and the seven temporary school houses in that neighborhood. Mayor McClellan announced last week that the Bridge Department would combine with the Street Cleaning Department in the general enterprise, the incinerator to burn the refuse being under the control of the Street Cleaning Department, which will turn the steam power created over to the Bridge Department in an adjoining building. There the Bridge Department, in a so-called machine shop, will turn the power into electricity. The Street Cleaning Department has $30,000 available for the construction of an incinerator and the Bridge Department has $60,000 available for a machine shop, so by building the structures on these general lines no further appropriation will be needed. Everything will now be lovely.

EXAMINATION OF ELECTRICIANS.—It is announced at the War Department that an examination for the position of master electricians in the army will be held at Willet's Point, N. Y., March 1 next. Applications should be forwarded to the commandant of the school of submarine defense at Willet's Point, N. Y., on or before February 15.

AFRAID OF FELLOW CITIZENS.—The Merchants' Association of New York is urging the Legislature to institute an inquiry into the telephone system in New York. The organization has addressed a letter to Governor Higgins in which it declares that a city investigation is not favored by it and asks that an investigation be made by some other competent power.

UNDERGROUND WIRES IN OMAHA.—By a recent ordinance passed by the Omaha City Council an extension of the boundaries of the underground wiring district has been made. This will affect the Western Union and Postal Telegraph Companies more particularly, as heretofore their wires have been permitted overhead. September 1 is the date allowed for compliance.

WHALE BREAKS ALASKA CABLE.—A special dispatch from Seattle, Wash., of January 25 says: "The cable between this city and Valdez, Alaska, which has been out of commission for nearly three months, is now repaired and the work of forwarding messages has been resumed. When the Sitka end of the cable was raised by the cable ship *Burnside,* a whale was found to be attached. The mammal's jaws were entangled in the broken wires, and the condition of its body showed that it had been dead for some time. It is the belief of the cable experts that the damage to the cable was caused by the whale."

WHERE GRAFT COMES IN.—In a discussion of the municipal lighting question, the Jersey City *Journal* remarks: "As private companies become more solidly established and resist extortion either because they have gotten monopolies or legislation has limited their charges, much graft revenue is cut off from crooked politicians controlling governing bodies, and municipal ownership gains headway. After one graft is lost the other may be substituted." The New York *Evening Post* says: "As was to be feared, the whole question of municipal lighting has come to be kicked about as a political football. Republicans and Democrats are in that matter simply trying to put each other 'in a hole.'"

ELECTRIC SERVICE IN WASHINGTON.—From the annual report of the electrical department of the District of Columbia for the fiscal year ending June 30, 1904, it is learned that of the lamps of all kinds in use for street lighting in Washington, 987 are arcs and 898 are incandescents. During the year there was laid for signal and telephone service 21 miles of cable containing 783 miles of wire, making a total of 42 miles of cable and 1,810 miles of wire now in use. The number of telephones connected to the District system is 229, while the total number of storage cells in use on June 30, 1904, was 1,146, of which 154 were added during the year. These cells are used on the police patrol, fire alarm and telephone circuits.

DINNER ELECTRIC CARS.—The London *Express* notes as follows: "England has added a new feature to odd dinners, which surpasses anything done in America. Messrs. Armstrong, Whitworth & Co. have built a small train specially for a millionaire, to take around decanters and cigars after dinner. The little engine, over which two dolls in blue overalls preside, is constructed of silver-plated copper in miniature reproduction of a Great Western locomotive. The tender is stacked with coal from the millionaire's own coal mine. When the millionaire touches a button the train starts. It runs quite slowly round the track and when a guest picks up a decanter the current is broken, and the train stops till he replaces it. The total length of the train, which is driven by electricity, is more than five feet, and the track is constructed for a twenty-foot table." There is nothing new in all this. It was done for Menier, the French chocolate manufacturer, at least fifteen or twenty years ago.

NO DEPRECIATION.—The municipal plant at Richmond, Ind., is said to be prospering—on paper. The cost is $200,000, including $30,000 "borrowed from the city." To make ends overlap, it is going into commercial business. "When asked as to the depreciation of the plant and necessity of re-equipment, it was stated by a commissioner that in figuring the showing of an institution of this character, no depreciation is accounted when a permanent expense fund is maintained, as in the case of the Richmond plant. The repairs made regularly maintain the proficiency of the plant, and no further provision is made, except in the incident of an unusually large breakage." We commend such financing to Mr. Lawson for attention. It is too "frenzied" for us.

THE GREAT STORM.—A severe blizzard with high wind and driving snow swept over the Atlantic seaboard States on Wednesday, January 25, paralyzing commerce, railroad traffic and all other intercourse except that by telegraph and telephone. Although the wind had a velocity of forty and fifty miles an hour, the snow was dry and, failing to lodge, left the pole lines intact at a time when they were badly needed. It took at least a couple of days to break out the steam railroads and restore schedules. In many Eastern cities the trolley lines were tied up, but the New York Elevated kept in constant operation and the new Subway did a tremendous business. The telephone exchange system in New York gave splendid service throughout and at night the girls were lodged comfortably in nearby hotels so as to provide for their welfare and have them ready to keep the busy switchboards in full operation.

ELECTRICITY AND BREAD.—A report to the Academy of Sciences at Paris on the result of an experiment with flour treated in both the ordinary way and by electricty, under similar conditions, states that the flour subjected to electric influence was much whiter in color, but that its taste and odor were far inferior to those of flour treated by the ordinary method. The amount of phosphorus was the same in both, but the quantities of fatty and acid substances varied largely. Thus, in flour treated by electricity the fatty substances proved rancid, glutinous, and of a less yellowish color, and instead of retaining their usual aromatic, yellow state, became oxidized and partly converted into white sebacic acid, which could be dissolved in alcohol. The glutinous substances were discolored and changed. The bread made from this flour was whiter than usual, but of inferior taste, and the experiment serves to demonstrate that electric treatment, while successfully turning flour whiter, injures it.

MORE SUBWAYS.—No single week on Manhattan Island is now fully rounded out that does not see a new subway system formally proposed. The Citizens' East Side Improvement Association has had the last guess. An entirely new plan for a second subway in the Boroughs of Manhattan and the Bronx was submitted to the Rapid Transit Commission last week, designed to displace the Parsons plan submitted in December. It is the work of James J. McDonald, former chief of civil engineers of the Denver and Rio Grande Railroad; Henry G. Wynne, former engineer of the Rock Island system, and Walter M. Meserole, of this city. Starting in the Bronx, from the vicinity of Westchester village, and running southwesterly to Manhattan under the Harlem River, the plan calls for a four-track route under First Avenue down as far as Twenty-third Street. There a division is made, each branch having one local and one express track. The downtown route would branch at Twenty-third Street, west into Second Avenue, down that avenue to Chrystie Street, through Division and Madison Streets, southwest in Madison to New Chambers Street, then by William Street around the Battery. It would then run north by West Broadway to Chambers Street, into Hudson, through Hudson to Abingdon Square, up Eighth Avenue to St. Nicholas Avenue and King's Bridge Road, Broadway, Sherman Avenue, to Two Hundred and Eleventh Street, under the Harlem to Fordham Road, through Pelham Avenue, and thence to Westchester to the point of beginning. The other route, after the separation at Twenty-third Street and First Avenue, will run east to Avenue A, and thence under Essex, Rutgers, Madison and Rose Streets, through Ferry to Water and Pearl to Whitehall and South Streets, thence under Washington, Christopher and Greenwich Streets, to Abingdon Square and Eighth Avenue, where it would rejoin the other line.

A CITY ELECTRICIAN.—The city of Seattle, Wash., is to have an electrician and chief inspector of electrical work. At least steps are now being taken to create the new office.

MR. T. A. EDISON has recovered rapidly from the operation for a mastoid abscess, and is on the high road to complete recovery. He expects to resume work at his laboratory at an early date and may go south to his Florida plantation.

THE TANTALUM LAMP.—According to the *Zeitschrift für Electrochemie,* the Siemens & Halske Company has taken out or applied for in Germany and other countries, 200 patents on the working of tantalum and its application to the incandescent lamp. The claims aggregate 1,000.

INDIANA PUBLIC UTILITIES ASSOCIATION.—The Indiana Public Utilities Association has ceased to exist. The organization of the association was largely due to Mr. A. M. Barron, formerly secretary, with headquarters at South Bend, Ind. Mr. Barron is now treasurer and general manager of the Southwestern Missouri Light Company, at Joplin, Mo.

AMERICAN RAILWAY, MECHANICAL AND ELECTRICAL ASSOCIATION.—A meeting of the Executive Committee of the American Railway, Mechanical and Electrical Association will be held on the morning of February 3 at the Holland House, New York, at which time the programme of the association for the coming year will be outlined. Mr. S. Walter Mower, of the Detroit United Railways, is secretary of the association.

AMERICAN ELECTROCHEMICAL SOCIETY.—The annual meeting of the American Electrochemical Society will be held in Boston and Cambridge, Mass., April 26 to 27. The programme of papers is not yet completed, but among those who will contribute papers are Messrs. Carhart, Blake, Reuterdahl, Carveth, Richards, Bancroft, Noyes and C. Gordon Richardson. There will be some interesting exhibits and several excursions are being arranged for. The headquarters will be at Hotel Lenox.

MASSACHUSETTS CAR FARES.—It is stated that the Massachusetts electric companies will make a strong effort to readjust the fares now in force upon their 900 miles of road. The average fare per passenger car mile last year was about three-quarters of a cent. Upon Western interurban electric roads the average fare per passenger car mile is one and one-half cents. It is thought that the public will see the justice of the position of the street railroads and be willing to pay an average of one cent per mile.

THE INSTITUTE ON THE COAST.—The San Francisco branch of the American Institute of Electrical Engineers was organized on January 20 by the election of the following executive committee: George O. Squier, major, Signal Corps, U. S. A., chairman; Prof. C. L. Cory, University of California, vice-chairman; Mr. F. V. T. Lee, manager the Stanley Electric Manufacturing Company; Mr. J. A. Lighthipe, engineer, the General Electric Company, and Mr. A. H. Babcock, electrical engineer, the Southern Pacific Company, local secretary.

PROTECTING THIRD RAIL.—A concerted effort is being made by the towns through which the third-rail system of the New York, New Haven & Hartford Railroad Company operates between Hartford and Bristol to protect the public against the dangers of the unprotected rail are taking definite form. Meetings have been held by the committees appointed by the authorities of the different towns, and it has been decided to seek relief through the Legislature. A measure will be introduced to compel the company to adopt suitable devices for safeguarding the rail.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.—The Committee of Arrangements of the International Association of Municipal Electricians will meet at Erie, Pa., February 13, to make arrangements for the next convention, set the date of the meeting and draw up a programme of papers to be read. The excellent work which this association is accomplishing is indicated by a recent printed list of the papers read before it, which cover every detail of the functions of municipal electricians. Mr. Frank P. Foster, of Corning, N. Y., is secretary of the association.

SPHERE OF THE TECHNICAL PRESS.—Members of the American Trade Press Association are looking forward with lively expectation to the meeting and dinner of February 18 at the Hardware Club, of New York, when Mr. Arthur Warren will address the body on "The Sphere and Usefulness of the Technical Press from the Manufacturers' Standpoint." Mr. Warren, himself a journalist of high reputation and long experience, is now director of the department of publicity of the Allis-Chalmers Company and is coming on specially from Milwaukee to discuss this very interesting and important topic.

NEW YORK INDEPENDENT TELEPHONE ASSOCIATION.—At a recent meeting of the Executive Committee of the New York State Independent Telephone Association it was decided to divide the State into 12 districts, each district to have its own organization and to meet at least four times during the year. The State association will meet once a year, and will be made up of delegates from the district associations. The next meeting will be at Albany in June of the present year. The meeting of the Rochester district has been called for Thursday, February 2, in Rochester, N. Y. Mr. T. S. Lane, of Buffalo, N. Y., is secretary of the association.

NEW YORK TRAVEL during the great storm last week was thrown almost entirely on the Elevated and the new Subway. The street car lines were overwhelmed with snow, and some remained out of service for several days, awaiting clearance. Vice-President Bryan, of the Interborough Rapid Transit Company, said: "The transit lines of New York were put to the most severe test of the winter during the recent storm. On the day after the storm—Thursday—the Elevated lines of the Interborough system carried 835,000 passengers, and the Subway lines 411,000, making in all a total of 1,246,000 passengers carried in twenty-four hours, with little or no interruption of traffic. The popularity of the Subway was clearly demonstrated, and the ease with which the 411,000 passengers were carried shows that the system with the present incomplete terminals and facilities is amply able to handle 150,000,000 a year."

CONTROLLER FOR ALTERNATING-CURRENT MOTOR.—In the operation of controllers which are employed for varying the active lengths of the windings of transformers from which alternating-current motors are supplied with variable voltage, the motor circuits are broken at each change or portions of the main transformer windings are temporarily short-circuited, and dangerous and destructive arcs are usually produced when either of these changes takes place. Two patents issued January 24, 1905, to Mr. Ray P. Jackson have for their common object to provide means for reducing the arcing between the parts of the controller. In addition to the main auto-transformer with its intermediate taps, the inventor uses an auxiliary transformer having a single primary, and either one or two secondary windings. The auxiliary transformer is switched into and out of circuit at such positions with reference to the main notches on the controller that its impedance chokes down the amount of current in a locally interrupted circuit, or its e.m.f. counterbalances the e.m.f., which would otherwise tend to produce an arc.

INSTITUTE ANNUAL DINNER.—A great deal of interest is being manifested in the annual dinner of the American Institute of Electrical Engineers, to be given at the Waldorf-Astoria, in the grand ballroom, on Wednesday, February 8, and devoted especially to signalizing the triumphs of electric traction. There will be a number of interesting speakers, and an original menu has been prepared appropriate to the occasion. Two novel features will also be introduced, namely, a mutoscope exhibition of steam and electric railway work and the taking of a picture of the ballroom and company by means of special Cooper Hewitt illumination. At the reception preceding the banquet there will be exhibited in the Astor Gallery the oil painting of Dr. Gilbert demonstrating his magnetic experiments to Queen Elizabeth, presented to the Institute by the British Institution of Electrical Engineers; and the fine bust of Prof. Ferraris recently presented to the Institute will also be exhibited. A great many applications have already been made for tickets, and in order to prevent disappointment it is earnestly requested by the dinner committee that members will send in their requests at once so that there may be no disappointment as to seating.

BRITISH MUNICIPAL TELEPHONY.—In spite of the prolonged agitation on the subject, only five municipalities in Great Britain have established telephone plants, and forty-one, after investigation, have decided not to do so.

MARCONI AGAIN ENGAGED.—The London *Express,* according to a cablegram dated January 23, announces the engagement of Signor Marconi to Eileen O'Brien, the fifth daughter of the late Baron Inchiquin, an Irish peer. The wedding, it is stated, will take place in London in March. This is not yet denied.

A DEMOCRATIC QUESTION.—Mr. Josiah Quincy, the well-known political leader, of Boston, Mass., says: "There is no principle that stands in the way of the municipal ownership and operation of an electric light plant. It is purely a commercial question in each particular case." It seems to be purely a Democratic question of how much there is in it for the gang which hangs above the crib in Boston waiting for the spoils.

CO-OPERATIVE LIGHTING PLANT.—A movement is on foot in Northboro, Mass., to build a small co-operative private electric light plant for supplying the principal places of business and residences with illumination. The plan is to install a gasoline engine and a direct-current dynamo having a capacity of two or three hundred lights. It depends for success at present advices upon the subscribing of about fifteen consumers within a fourth of a mile radius of the center of the town.

WATER FANS AND ELECTRIC.—Trouble has arisen at Syracuse, N. Y., over water waste in running fans and elevators. Commissioner Thompson states that in Delaware schools 76,000 gallons of water are used daily to drive ventilating fans, or enough for 1,000 families. Three school houses that are ventilated by fans driven by electric motors cost $375 a year each for power. These are Franklin School and the two high schools. If water were used the year around at Delaware school at the rate of 76,000 gallons a day it would amount to $5,000 at the family rate of $5 a year, or a dozen times the cost of running the fans by electric power.

THREE AND FIFTEEN.—A member of the lighting board of Mansfield, Mass., says: "We produce our electrical energy for less than 3 cents a kilowatt. This we sell for private uses, at 15 cents, with a scale of discounts on bills. There is a good profit in our private lighting and power contracts, and this profit goes to reduce the cost of public lighting to the town." We are waiting to see somebody get up and denounce the monopolistic avarice of this municipal plant in manufacturing for less than 3 cents and selling for 15. Had it been a private company—! Lamps of 1,200 cp on overhead circuits in Mansfield cost $80 a year, from this plant.

ELECTRIC LIGHT WRINKLES.—Mr. H. C. Abell, a business associate of Mr. Henry L. Doherty, has accepted the appointment of "Wrinkle" editor for the Denver-Colorado Springs convention of the National Electric Light Association. Mr. Abell has discovered a great many wrinkles in connection with central station operation, and knows where to learn of a great many more that, acting homœopathically, will tend to remove wrinkles of care from the brows of all the central station managers fortunate enough or wise enough to be members of the association. It is earnestly hoped that they will all lend their aid to make the "Wrinkle" department the greatest possible success.

ELECTRIC RAILWAY EXPERIMENTS IN SWEDEN.—Under date of November 20, 1904, United States Consul Robert S. S. Bergh, Gothenburg, Sweden, reports as follows: "In the spring the railway board petitioned the Government for permission to erect electric transmitting apparatus on land belonging to the State, between Tomteboda and Värtan, in order to carry out the experiments in electric railway traction, for which a grant of $134,000 has been made by the Riksdag. At Tomteboda station double wires will be used, and at Värtan the contact system will be employed for transmitting the current from the power station to the electric locomotive, the rails serving for the return current. For these experiments high-tension, single-phase current will be used. This question, so important for the whole country, has for some time been considered by the board of trade, and the board has recommended that the request of the railway board be granted, providing the permission to erect and use the apparatus be limited to a certain period, say five years, and that private rights are protected."

BROOKLYN POLYTECHNIC.—Some three-score universities and colleges were represented at the exercises attendant upon the installation of Dr. Frederick W. Atkinson as president of the Polytechnic Institute of Brooklyn in Plymouth Church, that borough, on the evening of January 21. William H. Nichol, chairman of the corporation of the Institute, presided. After President Atkinson had spoken Prof. Brainerd Kellogg, Dean of the Faculty, spoke in behalf of that body. An address was delivered by President John H. Finlay, of the City College. Paul Dougherty made the address for the graduates. For the municipality and the people of Brooklyn Borough President Martin W. Littleton spoke.

LAW BY TELEPHONE.—The practice is growing among lawyers of appealing to judges out of court, by mail and telephone, in cases pending. Justice Bischoff, of New York City, has filed a memorandum on the subject, in which he says: "Having announced my conclusion that the service of the summons by publication was defective, I am favored by mail with documents indicating personal service, and am requested to act upon this additional proof. The extra-forensic school has not overlooked the advantageous relation of the telephone to the ear of the court in pending matters. It is best that these innovative methods of seeking judicial action be made to await a change in judicial ethics, which may be induced by business conditions in their future development, but which has not as yet come to pass."

ENGLISH TELEPHONE GIRLS.—The London *Pall Mall Gazette* delivers itself thus as to telephone exchange management in that city: "The hated sumptuary laws for telephone girls are to disappear conditionally. They were stringent, unquestionably. The girl who came to work in the morning with a colored comb in her hair was fined; the girl who dressed in a colored blouse must wear a dreadful black overall, and there was a black book for girls who put on beads. For six months the telephone girls are to dress as they please, with the understanding that if the privilege be abused things will revert to their former hideousness. We hope they will be happy and clever, and pay great attention to what they are told. Something has been wrong with them, notoriously. But if they will settle down now—talk less about what they wear and attend to the telephones—the state of busy London will be more endurable."

PUBLIC ARC LAMPS IN LONDON AND PARIS.—The New York *Herald,* in a cablegram, gives the following data as to the cost of public arc lamps in London and Paris, the information in the former case having been obtained from the several council engineers. In London out of a total of 81,097 street lights only 6,159 are electric, the remainder being gas. Only 19 of the 29 councils in greater London employ electric lighting and three have only 17 lamps between them. Of the 16 remaining, some have as few as 77 lamps and one as high as 507, and the City of Westminster has 5,141 arcs. In the city district the average cost of electric arc lamps is $130 per year. In Westminster the rates vary from $110 to $150 per year. In Paris there are 1,541 arc lamps. On the boulevards the rate paid for arc lighting is 6 cents per hour per lamp, the number of hours per year being 2,496. It is stated that the cost of keeping up the lights is calculated at $160 per annum.

DRAGON CONTROLLED BY TELEPHONE.—Our Chinese friends will be interested in the way foreign devils control dragons. In the opera "Siegfried" a dragon is an important feature of the entertainment. This opera was rendered at the Metropolitan Opera House in New York recently. The insides of the dragon, which is made of canvas and papier-maché, consist of two small boys, who are supposed to guide the beast's movements in accordance with the music. They are rarely equal to doing that correctly, even after rehearsal. The performance the other night is said to have been given without a single stage rehearsal, as no time could be found for the preparation of the opera. It was, therefore, more than ever necessary to have the occupants of *Der Wurm's* inside kept up to their business. The stage manager decided to install a telephone in the beast. It connected with the opera house switchboard. On one end was Herr Greder, the stage manager, and at the other were two receivers strapped to the heads of the two boys, who received momentarily directions as to what they should do. The dragon under the circumstances covered himself with credit.

COLUMBUS OVERHEAD WIRES.—Steps are being proposed to place the wires in Columbus, Ohio, underground, and the West Side Board of Trade has adopted resolutions to that effect for immediate action.

LIGHT AND NEWS.—The recent labor and political troubles in St. Petersburg resulted in the stoppage of newspapers and the shutting down of the electric light plant. The newspapers were not seriously missed, but the absence of electric lighting was both a deprivation and a hardship.

HOTEL FOR "HELLO" GIRLS.—A cable dispatch from Paris says: "A project for a hotel for telephone girls has been completed. Senator Jules Siegfried, former Minister of Commerce, is president of the organization having the matter in hand. Extensive grounds have already been purchased. The hotel will have 100 apartments, a co-operative restaurant and a library."

TELAUTOGRAPH IN FRANCE.—A cable dispatch from Paris of January 14 says: "The French Government is experimenting with a telautograph for the purpose of its adoption throughout France. The instrument sends a telegraphic dispatch, reproducing at the receiving end the handwriting of the sender. Thus very soon in France one may be able to sign checks or legal papers in one city when present in another."

A SUBWAY FOR BERLIN.—A cable dispatch from Berlin of January 12 says: "The city has won its long-pending suit against the Street Railway Company, which sought under its concession to prevent the city from authorizing the construction of an underground railway in streets with surface lines. A private company partially supported by the city's credit will now construct a new line to relieve the down-town congestion."

WHAT BEMIS THINKS.—"While it is true," said Prof. E. W. Bemis, a municipal plant advocate, testifying at the gas hearing in Boston, "that the electric light tends to displace gas in streets, places of amusement, fine homes and in certain lines of business, yet, on the other hand, it is doubtful whether, on the whole, gas for lighting purposes is much injured by electricity. If there is a loss, it is more than made up by the increased use for heating and cooking purposes. I do not think that the gas companies are feeling the competition. In my opinion they are, in general, on a securer foundation than is the electric light business."

POSTAL RAILROAD WIRES.—At the present time 6,000 miles of telegraph wires and 195 miles of poles are being put in place on the New York and Maryland divisions of the Pennsylvania Railroad by the railroad company and the Postal Telegraph Company, to replace the wires now being removed by the Western Union. Sixty miles of poles are being placed along the New York division by the railroad and 135 miles on the Philadelphia, Baltimore & Washington division. The railroad company also is stringing 1,500 miles of wires for its own use. The Postal Telegraph Company is putting in place 1,500 miles of wires on the Maryland division and 2,500 miles of wires on the New York division. It is estimated that the cost of changing the service from Western Union to Postal will aggregate $125,000. Meantime the Pennsylvania is still chopping down Western Union poles along its track, under the decisions in its favor.

CUTTING TELEPHONE LINES.—It is understood that the overhead circuits of the New York Telephone Company are to be cut down wherever they are "improperly" strung across streets and city property and the city will sue for damages if the plans of two departments are carried out. The Department of Highways has been investigating complaints of citizens of Manhattan that telephone wires have been strung over their houses and across streets and is preparing notices ordering the company to make changes which will mean the overhauling of their wire system in many parts of the borough. If the alterations are not undertaken by February 1 an axe brigade will start out. The Corporation Counsel's office also has been investigating, and Mr. Delany is convinced that the action of the telephone company in stringing wires over streets has had the effect of violating portions of the franchise. Papers are being prepared in an action to recover damages and invalidate certain franchise provisions. This suit and the action to seize the subways and ducts of the Empire City Subway Company are taken in some well-informed quarters as parts of a political effort to let in a competing telephone company.

TWENTY-FIVE MILES OF CITY.—An article in the *Four-Track News* for February, discussing the adoption of electricity on the New York Central, says: "The greatness of Greater New York has received a wonderful impetus by the successful adaptation of electricity to rapid transit. Few people whose business confines them to the city prefer to live on Manhattan Island, and when the rapid transit facilities which will be inaugurated within the so-called "electric zone" are perfected, there will be no excuse for their doing so. Then Tarrytown will be as near as Yonkers, and Yonkers will be brought within such easy access that Greater New York's growth to the north will result in a solid city for twenty-five miles from the Battery along the Hudson. The birth of a new era in suburban growth is at hand and, with the increased facilities which electric service will afford, one of the most perplexing problems of the day, in all large cities, will be solved."

A FIFTH AVENUE SUBWAY.—The Committee on City Plan of the Municipal Art Society of New York City has sent to the Board of Rapid Transit Commissioners a proposition for an "alternative" to the Parsons scheme for the perfection of the Subway plans for the Boroughs of Manhattan and the Bronx. There is suggested for an east side route a four-track line starting from William Street and running north through Park Row, the Bowery, Canal Street, Allen Street, First Avenue, under the Harlem by tunnel, and thence north under Willis Avenue, Third Avenue and Boston Road to Mount Vernon. The plan also provides for an extension to Brooklyn and ultimately a tunnel to Staten Island. With a connection at the south end of the city the plan calls for a Fifth Avenue route, beginning at the William Street loop and running north under Greenwich Street, West Broadway, Fifth Avenue and Jerome Avenue to the Yonkers line. This would do away with the proposed extension of the Sixth Avenue Elevated road, and would give a central express line from the Bronx district. It is becoming rather difficult to keep track of all the subway schemes now proposed for Manhattan Island.

TELEPHONE DIRECTORIES.—Another edition of the Washington telephone directory is now on the presses, says the local *Star*. Big publishing houses usually regard an edition of 200,000 or 300,000 copies of a book in which extreme accuracy in matters of typography is requisite as a big undertaking, even when every line of the copy has been written precisely as it is to stand before it goes to the printer. There are certain books, however, that are continually appearing in large and ever enlarging editions which are subject to almost innumerable revisions up to the last moment before the forms are locked and the great presses begin to click them off. These are the telephone directories—not, perhaps, literary productions of highest merit, but presenting certainly the most marvelous example of combined rapidity and accuracy known to the publishing world—a work which keeps presses running twenty-four hours in the day for several days before each issue, which depends upon the most careful system in an industry that owes its whole efficiency to system. Getting out big editions of popular novels or school geographies is mere child's play compared with the task of issuing telephone directories in our larger centers of population for a couple of million subscribers.

RAILROAD TELEPHONY.—It is claimed that the Baltimore & Ohio Railroad is the first steam railroad in the world to govern systematically the movement of trains by telephone. A conference of the dispatching force was held recently at Baltimore and a set of rules and forms was arranged, and it is the expectation that every non-telegraph station that has a passing siding will be fitted up with a telephone connection to the nearest telegraph office. This will enable the transmission of train orders from the telegraph office to the train crews at such sidings direct, or to an employe stationed there for that purpose. The first successful use of the telephone has been for single-track blocking between Newark and Bellaire, Ohio. The telegraph offices average about eight miles apart, and at many points the siding extends beyond the telegraph office a distance of about two miles. By having the telephone located at the switches a train is allowed to use the passing siding up to the outlet switch. Then, as soon as the train for which it has been held has passed the conductor notifies the operator in the block signal tower, and he receives permission to proceed with his train to the next block signal office. The result is practically to shorten the block by one-half the distance and to hasten the movement of traffic to that extent. The Baltimore & Ohio system, it will be remembered, was the first on which the telegraph was tried.

Central Station Work in Detroit.—I.

CENTRAL station electric lighting service in Detroit has followed about the same general course as in most of the larger cities of this country, and has now just reached the stage of centralized supply from one large generating plant, with such use of steam apparatus at sub-stations as will be described in detail in this article. Series arc lighting began in Detroit in certain stores in 1880. Public supply began in 1882. The first contract for electric street lighting was given in 1883. The Edison direct-current supply began in 1886 from a station in the downtown district. The Edison service giving 120 and 240-volt supply in the downtown district was gradually enlarged so as to call for the building of other stations to supply it. In 1888 the Brush Electric Light Company built a large arc light plant (now Station C) at the edge of the city into which alternating-current apparatus was later introduced. Alternating-current supply was started in 1890. Later all the central station lighting business of the city came under one management. This naturally led up to the present stage, viz.: the building of a large

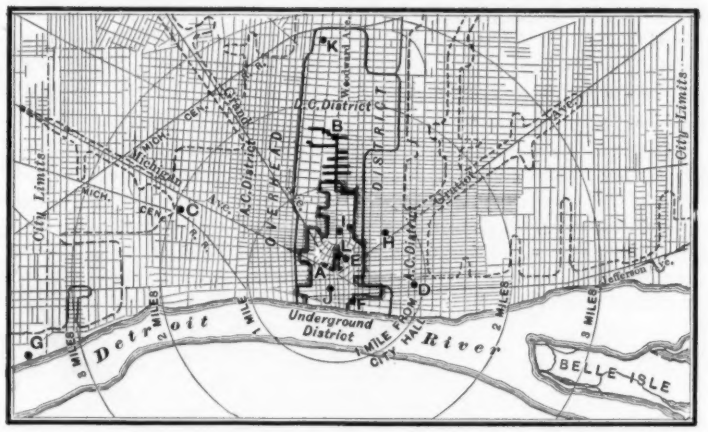


FIG. 1.—MAP SHOWING LOCATION OF STATIONS AND SUB-STATIONS.

generating plant in some outlying district convenient to coal and water. The Brush station referred to was a result of the same decentralizing idea, viz.: a large generating plant in the outskirts of the city with convenient coal supply and cheap land, but was away from condensing water and in no respect large enough for present day requirements even could the plant have been entirely rebuilt.

There are a number of features peculiar to the central station service in Detroit which make the situation there of special engineering interest. Some of these features are:

1. The large new generating station at Delray, employing 3,000-kw turbo-generators.
2. The generation and transmission of electrical energy at 4,600 volts, three-phase, 60 cycles, as against 25 cycles commonly used elsewhere for transmitting to direct-current sub-stations.
3. The use of motor-generators instead of rotary converters at sub-stations for converting from alternating to direct current.
4. The use of steam engines at certain sub-stations and the supply of steam heat from these sub-stations.
5. A system of tie lines which enables engines to be run during the steam heating peak on certain sub-stations to help out the electric load peak on other sub-stations.
6. The extensive use of electric power and the distribution of power direct to factories by means of 4,600-volt, three-phase circuits.

Each of these features presents some interesting propositions, each of which will be discussed in its turn.

Taking up first a general survey of the situation in Detroit, the accompanying map, Fig. 1, shows the city of Detroit with the various stations and sub-stations. The stations in the direct-current district are the property of the Edison Illuminating Company, of Detroit. The alternating-current district is supplied by the Peninsular Electric Light Company. Both companies are supplied with power from the large new station at Delray, which is Station G on the map. This station is owned by the Detroit Edison Company, a New York corporation, which controls the two companies previously mentioned. The Detroit Edison Company also sells power to the Detroit United Railway Company.

The map shows the "underground" district downtown, adjacent to which is an overhead direct-current district occupied since 1901 by the Edison Illuminating Company, and which extends north from the underground district for about two miles through a residence portion of the city. Surrounding these direct-current areas is the alternating-current district, all of which is supplied by overhead wires. It will be noticed that in the outlying districts the territory covered corresponds with the principal thoroughfares which radiate in various directions from the center of the city.

Station A was the original Edison generating station for the downtown district. It is a four-story building adjoining the Cadillac Hotel. It had originally about the same characteristics as the Edison central stations in other large cities, namely, engines on the main floor belted to generators on the second floor, and a cramped boiler room supplemented later by a second "deck" of boilers and two direct-connected, 500-kw sets. Now that the Delray generating station is ready to supply current, Station A is rapidly being changed from a steam plant to a sub-station. Half of the steam plant has already been removed. It is intended to make this ultimately a sub-station and office building only. The offices are now in the two upper floors of this building, and more room is needed. A 1,000-kw motor-generator set was installed, just before the beginning of the December peak load to assist the remaining steam plant here. The steam machinery will be all removed and four 1,000-kw motor-generators will be placed in what is now the upper boiler room. Two 230-kw motor-generator balancing sets are also to be put in this station.

Station B is in a rich residence district immediately north of the business part of the city. It has been a direct-current steam plant, and at this place part of the steam machinery will be retained and the two 500-kw direct-connected sets now at Station A will be installed so as to make it a combined motor-generator station and steam plant. The reason for retaining the steam apparatus at this station is that steam heating has been done in the surrounding district for some time. The steam heating business is carried on by a corporation called the Central Heating Company. The mains of the Central Heating Company are indicated on the map. The electric peak load in this district does not come at the same time as the steam heating peak load. By far the greatest instantaneous demand for steam by the steam heating system is early in the morning, after residences

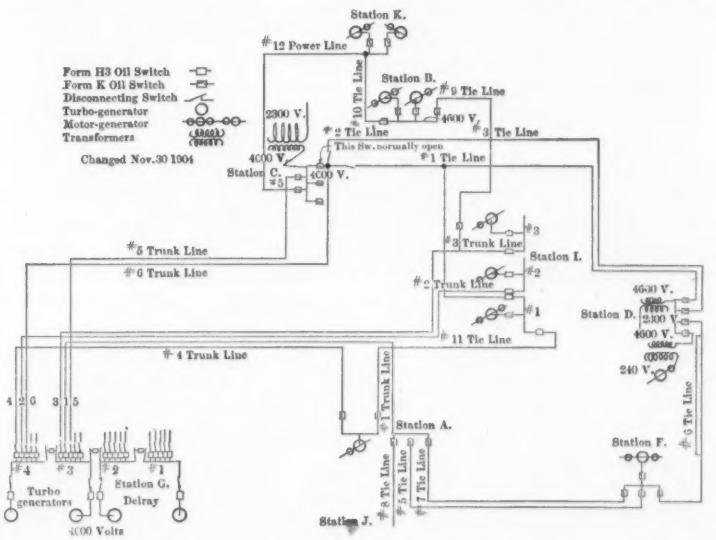


FIG. 2.—DIAGRAM OF TRUNK AND TIE LINES.

have been allowed to cool down during the night and the occupants desire to warm them up quickly. If Station B were running as a generating plant by itself, this difference between the peak of the heating load and the lighting load would be bad from the standpoint of economical operation. However, by virtue of the tie lines connecting it with the other stations, it is possible to give this station enough load so that a large amount of exhaust steam can be supplied to the mains during the peak of the heating load in the morning. The peak of the heating load corresponds very closely with the morning peak of the electric supply to the Detroit United Railway Company, so that the two demands fit in very well together. Station B being in the residence district where hard coal is used exclusively for the heating of private residences, it is possible to secure a profitable rate for heating by virtue of the fact that a much cheaper coal is burned under the boilers in the station than would be burned by private residence owners in their individual heating apparatus. This

station, when the changes are completed, is to contain two 500-kw and one 200-kw engine-driven, direct-current sets. It has now a motor-generator set of 300 kw and a motor-generator balancing set of 230 kw, to which an additional 600-kw will be added when required.

Station C is the old alternating-current steam plant of the Peninsular Electric Light Company. It is located 2¼ miles west of the business center. This station is to be altered and 900-kw transformers are already placed in it for the purpose of stepping down from 4,600 volts, three-phase, to 2,300 volts. The single-phase, 2,300-volt distribution for lighting in the western part of the city will be continued from this station as before. About 1,000 kw in steam-driven, 2,300-volt alternators is to be left at this station because of a possibility of securing some steam heat and power business from factories located near this plant, the idea being that it may be possible to secure certain factories as customers for power if the company is also in position to offer them steam heat. This station was originally an old-style, two-story, electric light station, with small dynamos on the second floor belted from a line shaft on the first floor, to which since 1900 there have been added two direct-connected 350-kw sets. The second floor is to become the company's arc lamp repair shop and switchboard shop. The company assembles its own switchboards. The first floor is to be used as a general machine shop, and a storeroom 120 by 165 ft. is being built on the adjoining lot.

Station D, east of the business center, is a sub-station which supplies alternating current. It contains 900 kw in step-down transformers, receiving 4,600-volt current and sending out 2,300-volt current for supplying the alternating-current district in the eastern part of the city. This station also has a 75-kw motor-generator set, which supplies a limited amount of 240-volt direct current used entirely in elevator service and automobile battery charging. There is no steam apparatus at this sub-station. It was built simply as a step-down and regulating station.

Station E is a storage battery station in the downtown district on a street a little to one side of the main business section. The building is arranged with the storage battery in the basement. The front part of the building is occupied with boosters and end-cell switches and a small apartment occupied by the electrician in charge. The battery is of the chloride type, of 160 cells, of which 60 are connected to the end-cell switches. The capacity of this battery is 5,280 amp.-hours at the one-hour rate, and a final voltage of 270 volts.

Station F, which was formerly a direct-current steam plant, is located in a wholesale warehouse district. The steam machinery is being taken out and a three-unit balancing motor-generator set of 460 kw is already in service. The additional plant in this station is to be a 1,000-kw motor-generator set. The meter testing department is located on the upper floor of this station.

Station G is the new power plant at Delray. It contains three 3,000-kw Curtis turbo-generators, giving 4,600-volt, 60-cycle, three-phase current. There is room in the plant for one more 3,000-kw set. In this plant is also a 1,000-kw motor-generator, giving 550-volt direct current for the Detroit United Railway. Step-down transformers of 150 kw capacity are installed here for lighting the village of Delray.

Station H is the small independent station of the East Side Electric Company, whose stockholders and officers are closely connected with the Edison Illuminating Company. It contains a motor-generator of 150 kw, in which the motor is an induction machine which drives two direct-current generators, forming a balancing set. It contains also a 200-kw steam-driven generator.

Station I represents the company's newest and best construction in the way of a sub-station. It is in the northern part of the direct-current underground district in a handsome building erected especially for the purpose. It contains two 1,000-kw motor-generator sets, the generators of which give 270 volts direct current. There is also a balancing set of 460 kw, consisting of a synchronous motor driving two direct-current generators, one for each side of the three-wire system.

Station J is located in the basement of the Murphy Power Building, in the downtown office building district. It contains a motor-generator of 250 kw, also the meters and switchboard to control a supply of 450 kw, which is purchased during the winter months from the Murphy Power Company. The Murphy Power Company does a steam heating business.

Station K is located at the extreme northern end of the direct-current district. It contains two 150-kw motor-generator sets supplying direct current and a pair of 50-kw generators used as balancers. The reason for the location of this sub-station in what appears to be a peculiar place on the map is the recent erection of a number of factories along the railroad belt line at that place and the equipment of these factories with direct-current motors.

Station L is a steam-heating boiler plant located in the downtown district and belonging to the Central Heating Company. It can hardly be called at present a part of the Detroit Edison system. It is still under construction and the present equipment plans call for nothing but boilers and coal storage, the latter being located in the upper part of the building; but the building has provision on a well-lighted floor above the coal pockets for the placing of two 500-kw turbine units. The characteristic of a steam-heating service already noted that its peak does not coincide with the lighting peak will permit the division of boiler power from the heating mains during the lighting peak, sufficient to operate these turbines.

From this review of the situation it is seen that the general scheme is to supply nearly all of the power from the new turbo-generator station at Delray, taking out all of the steam apparatus at the distributing stations except where there is a possibility of using exhaust steam for heating—or, as proposed at Station L, of using heating boilers during electric peak hours in such a way as to economically combine the two public services.

The maximum load this season in the downtown direct-current district was 5,200 kw. In this district, as the map shows, the sub-stations are numerous, due to the density of the load in the underground district. There are five stations in this district. The maximum load on the entire system during the past season was 8,100 kw.

The total horse-power in motors connected is now 5,475. Of this total, 555 hp, represented by 103 motors, is in alternating-current motors, and the remainder, 4,920 hp, is in 914 direct-current motors.

In the reconstruction certain standards have been adhered to as far as possible, the exceptions occurring where old apparatus has been utilized. The standard motor-generator for sub-station use in transforming from 4,600-volt, three-phase to direct current is a 1,000-kw unit, consisting of a synchronous, 4,600-volt, three-phase motor driving a 270-volt, direct-current dynamo. To balance or compensate for the difference in load on the two sides of the three-wire system, a 460-kw, three-unit motor-generator balancing set is the standard adopted. This set consists of a 4,600-volt, three-phase induction motor (or, in the latest sets, a synchronous motor with a squirrel-cage winding in the poles of the revolving field), driving two 135-volt, direct-current dynamos. The standard underground "trunk" feeder from the Delray power station to the principal sub-stations is a three-conductor lead-covered cable with 200,000 circular mil conductors, covered with 5/32-in. paper insulation, tested to 18,000 volts. Branch 4,600-volt lines to the smaller sub-stations are three-conductor, lead-covered cables with No. 2 conductors, paper or cambric-insulated, and tested to the same voltage.

Although residence and miscellaneous lighting in the outlying districts is done by 2,300-volt, single-phase current, it is the intention to take factory power and lighting on 4,600-volt, three-phase distributing lines supplied without transformation. Step-down transformers for both motors and lighting are tapped off the three-phase, 4,600-volt lines as required. The standard overhead distribution circuit for this purpose has three No. 0000 wires, carries 1,000 kw, and has its voltage regulated at the nearest sub-station by an air-blast I. R. T. General Electric pressure regulator of 75 kw capacity. Two of these distributing circuits are already in operation, and it is by such alternating-current distribution that most of the factory districts will be served.

The electrical connections of Station G, the Delray power station, with the various sub-stations, are diagrammatically indicated in Fig. 2. On this diagram each connecting line represents one three-phase transmission line. The diagram also indicates roughly the scheme of connections of generators and feeders in Station G. Commencing with the 4,600-volt generators, it is seen that each generator is connected through a Form H3 oil switch to one section of bus-bar. There is one section of bus-bar for each generator. Generator No. 1, indicated on the diagram, and its corresponding section of bus-bar has not yet been installed. Each bus-bar section has leading from it five Form H3 oil switches for connecting and disconnecting feeders. At the time the diagram in Fig. 2 was made there were six feeders in operation. Each bus-bar section on the switchboard

can be connected to its adjacent section by means of an oil switch which performs the part of a tie switch. Two trunk line feeders run to Station I, two to Station A and two to Station C. The remainder of the stations, namely, K, B, D, F and J, are fed through what are called tie lines, which are in reality continuations of the trunk transmission lines through the receiving sub-stations.

The object of bringing these trunk lines through the sub-stations is to enable various combinations to be worked in case of the breakdown of a trunk line. For example, No. 3 trunk line runs from Station G to Station I, where it is connected to No. 3 section of the bus-bar in Station I by means of a Form H oil switch. This bus-bar normally supplies one of the 1,000-kw motor-generators. There is, however, a branch from this No. 3 trunk line before it reaches the oil switch, and this branch leads to the Form K oil switch, by which connection can be made to No. 9 tie line connecting with Station B. This tie line leads through a Form K oil switch at Station B directly into the bus-bars. Supplying these same bus-bars in Station B is the No. 10 tie line coming from Station K. All of the permanent switches and connections are illustrated in this diagram, which shows the great flexibility of the transmission system as regards ability to operate all the stations with some of the trunk lines disabled. Further flexibility, moreover, is secured by means of temporary jumpers at Station I. Fig. 3 is from a photograph of the switchboard at Station I. Form H3 oil switches can be seen on the gallery; the switchboard proper is on the main floor. Just behind the switchboard, on the left, can be seen four porcelain sockets serving as ter-

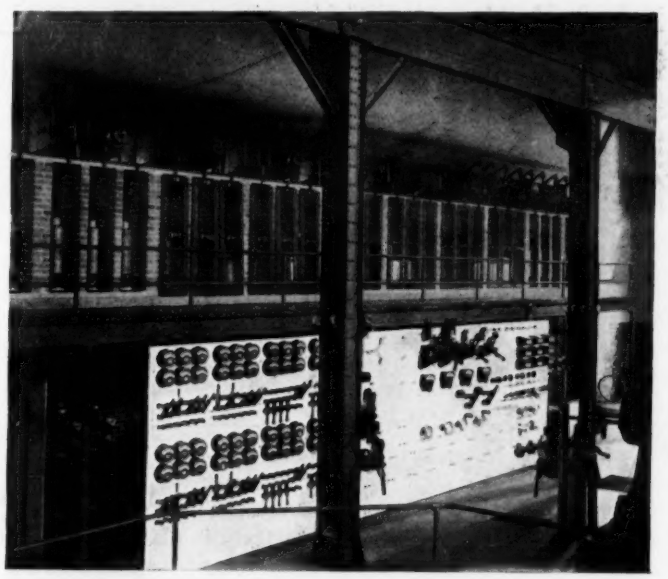


FIG. 3.—SWITCHBOARD AT STATION I, DETROIT.

minals of the high-tension cables. Into these sockets plugs can be inserted, these plugs being on the ends of cables, which again connect with other similar sockets to form different combinations. When in normal operation a short piece of cable is used to connect the sockets on the same block. If other than regular connections are desired, jumper cables long enough to run some considerable distance to other sockets are used.

The transmission lines from Delray to Stations I and A go through the conduit shown under construction in Fig. 4. Within two years another conduit line already partly built will be in use, thus providing two distinct underground lines from the Delray station. In the meantime the middle section of the line to Station C is temporarily overhead, as also is a stretch of 1,000 ft. immediately next to the Delray station.

In the high-tension scheme of distribution automatic overload devices have been omitted from the high-tension lines at the sub-stations, nor are there any "reverse-current" devices. The only devices which will open the high-tension circuits automatically are the time limit overload relays on the oil switches at the Delray power station. These and the circuit-breakers on the direct-current side of motor-generator sets are the only automatic overload devices in connection with the direct-current supply. It is thought that while reverse-current relays are undesirable at sub-stations it will, nevertheless, be advisable to have some way of indicating at a glance when a direct-current generator is running as a motor, and such provision may be made on the generator ammeters.

As outlined at the beginning of this article, one of the principal peculiarities of the new Detroit system is the use of motor-generators instead of rotary converters for converting from alternating to direct current. In the opinion of the officers of the company the gain in reliability of operation by the use of motor-generators as against rotary converters is more than sufficient to warrant the increase (both in first cost and in operation) of the motor-generators over the rotary converters. The points urged against the rotary converters are the greater danger of surging and getting out of step, danger of running away as a result of inversion, and the difficulty of accurate voltage regulation. Having once decided upon motor-generators for converting to direct current, there was of course no question as to the best frequency to choose, since 60 cycles would work as well with motor-generators as would 25 cycles, and 60-cycle current could be used for alternating-current lighting without the use of frequency changers. In selecting motor-generators and 60-cycle generation and transmission, the Detroit Edison Company has taken the opposite horn of the dilemma from the majority of large central station companies of the country. The dilemma which confronts nearly every central station company in a large city which tackles the problem of building a large generating plant to generate one kind of current and one only is that the downtown districts are operated with direct current and the outlying districts have alternating-current distribution at 60 cycles. If the downtown district

FIG. 4.—CONDUIT LINES FROM DELRAY STATION UNDER CONSTRUCTION.

is to be supplied from sub-stations using rotary converters, good engineering practice dictates the use of 25-cycle supply, since 60-cycle rotary converters are too near the danger line between reliable and unreliable operation to be relished by the more conservative engineers. The generation of 25-cycle current demands the use of motor-generator sets in the outlying districts to change from 25 to 60 cycles for the alternating-current distribution. As by far the greater part of central station load is in the shape of direct current supplied to the central part of a city, the decision usually made has been to generate at that frequency which can be converted for use as direct current at the lowest first cost of apparatus and at the highest efficiency. This has resulted in the use of 25-cycle generators and rotary converters in the direct-current sub-stations, because rotary converters are not only more efficient but lower in cost than motor-generator sets. Thus the generating plant is built to conform best to the greatest part of the company's output, and the outlying districts must be served through motor-generator sub-stations. At Detroit, although the objection to rotary converters was apparently the chief factor in the decision to generate 60-cycle rather than 25-cycle current, there was a further consideration, namely, that active campaign was about to be begun for the power and lighting load for the manufacturing districts. These districts being scattered around the outskirts of the city, 60-cycle distribution is, of course, best for this purpose, since 60-cycle induction motors serve admirably most of the uses of a manufacturing plant, and factory lighting could be done off the same feeders.

In connection with the mention that has just been made of the company's campaign for power load, it is in order to mention the fact that a number of large factories are already connected or under contract for central station supply. The rates which the company is making are such that it is very difficult, if not impossible, for a manufacturing concern to meet them with an isolated plant. All rates are differential and based on the customers' maximum demands. For amounts greater than the equivalent of 30 hours' use per month of this maximum demand, customers are given discounts which, for a large, steady power user, operating 3,000 hours per annum, may bring the net cost as low as 3.1 cents per kw-hour.

The rates of the Central Heating Company, although having nothing directly to do with the central station service, may be of interest to central station managers of other cities. As before explained, the Central Heating Company has thus far done its heating in a residence district where anthracite coal was used exclusively. This, of course, means that it is much easier for steam heat to compete with furnaces and boilers in private houses fired with anthracite coal than would be the case where the customer would use soft coal. Steam is sold to residences by meter at the rate of 47 cents per 1,000 pounds of condensed steam passing through the meter. This is on the average, and under Detroit conditions equivalent to 25 cents per square foot of radiating surface per season.

SUB-STATION I.

Having taken up the company's practice in general, consideration will now be given to the principles of construction employed in the most modern sub-station and at the great Delray generating plant. The sub-station designated I is the one selected for description. The switchboard of Station I is illustrated in Fig. 3. Other features in the construction of this station are shown in Figs. 5 and 6. Fig. 5 is a general view of the interior taken from the crane, showing the two 1,000-kw units and the one 460-kw unit, the latter being a three-unit balancing set. The crane runs the length of the station over the heavy machinery. Behind the switchboard at the left can be seen some of the jumpers with plugs already referred to in connection with the high-tension feeding system. Fig. 6 is an exterior view of the station.

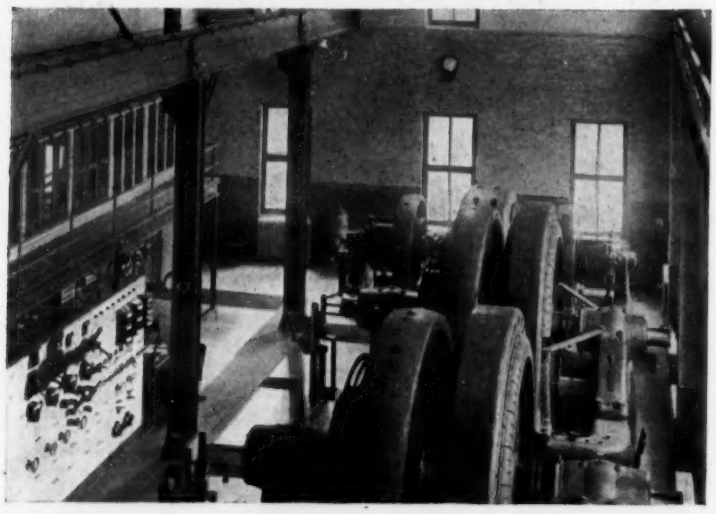


FIG. 5.—INTERIOR OF STATION I, DETROIT.

As seen in Figs. 3 and 5, a hand-operated, direct-current circuit-breaker is mounted on a standard close to each machine, and beside it is the starting switch by which the motor-generator is brought up to synchronism from the direct-current side. As seen in Fig. 3, the direct-current switchboard is at the left, and the alternating current at the right end of the board. The direct-current board has two sets of bus-bars to permit the use of higher voltage on some of the feeders. The Form H3 oil switches in the gallery have glass doors in front of their compartment. The glass in these doors is of the fire-resisting type used in fire-proof building construction, having enclosed within it a wire netting to prevent its falling apart should it crack. The wiring behind the alternating-current switchboard is very neat and free from the complications sometimes found on such boards. As far as possible, the small wires of the various instruments and oil switch circuits are run directly from their respective switches or instruments to the bottom of the board, thus avoiding cross-connection between panels at the back of the board, these cross-connections being the chief source of complication on boards of this kind as frequently wired.

As can be seen by the engravings, the building is of brick, steel and concrete construction and there is nothing combustible in its make-up, not even the window sashes, which are of galvanized iron. As it is in the underground district, all the wires enter and leave through the basement.

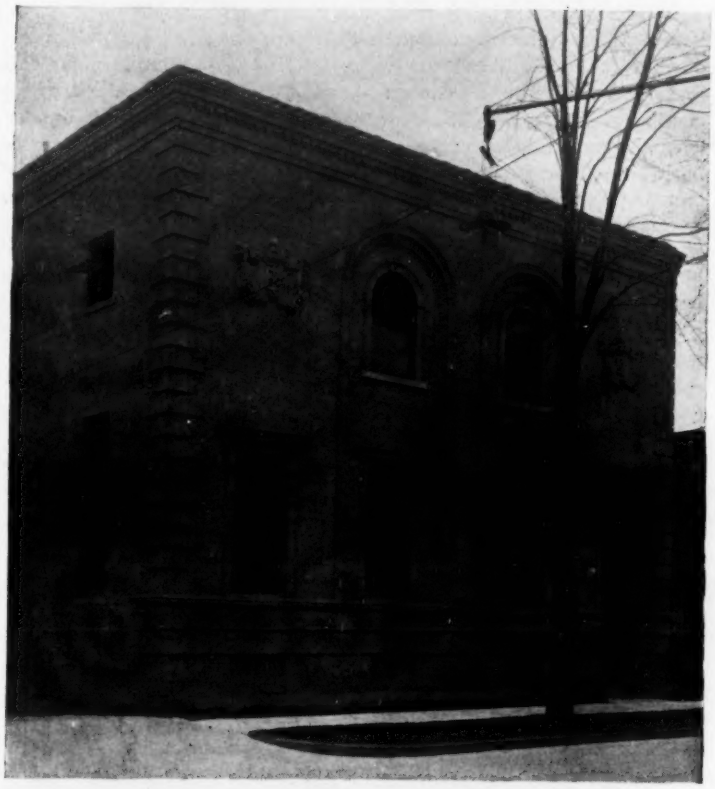


FIG. 6.—EXTERIOR OF STATION I, DETROIT.

Results of Municipal Ownership in England.

One hears a great deal about the favorable, or assumed successful, results of a municipal plant here and there in England, but it has been difficult to obtain data as to the results of the whole movement; although well-informed economists have lately been calling attention to the increasing burden of municipal debt and the diminishing percentage of return. Some very interesting and striking figures are now presented by Mr. John Holt Schooling, who has summarized the final report of the Royal Commission on local taxation, the annual reports of the local government board and the other official returns of local rates and taxes. This expert has gone into every branch of the subject, and the resultant figures are such as to alarm and startle even the most sanguine advocate of the municipal plant gospel and propaganda. Mr. Schooling does not discuss the question at all whether it is wise or not for the authorities to go into "reproductive undertakings," outside the regular purposes and principles of municipal administration. He is not concerned with that at all. As an economist he has simply tabulated the financial results.

Mr. Schooling shows that the burden of municipal debt had risen by 1901 to not less than £317,000,000, and that it approximated £10 per head of the population, being in 1899-1900 equal to £917 per 100 of population and £167 per £100 of rateable value of property. Moreover, for the year 1900-1 the total municipal expenditure was £110,385,000, equal to £340 per 100 of population and to £61 per £100 of rateable value. These figures alone might "give pause," but the argument is raised that a great deal of this money represents profitable investment in "reproductive undertakings," so Mr. Schooling examines that point and classifies these enterprises from other sources of income and outgo. He notes that 299 corporations out of 317 are in business, and that the 299 run, each of them, an average of 3½ undertakings apiece. The total capital invested was £121,000,000, of which £117,000,000 was borrowed capital. Of this borrowed

money, only £16,000,000 had been paid off at March 31, 1902. Mr. Schooling has carefully grouped the 1,029 undertakings and gives the results in the following table:

Description of "Reproductive Undertakings."	Capital Invested.	Average yearly profit or loss per £100 of capital invested.
		Per £100 of capital.
Worked at a profit:	£	£ s. d.
Waterworks	56,940,000	0 3 2
Gasworks	24,030,000	1 12 10
Tramways:		
I. Owned and worked by the corporations	8,610,000	0 19 0
II. Owned but *not* worked by the corporations.	1,140,000	1 10 6
Markets, etc.	6,180,000	1 7 1
Other "reproductive undertakings"	720,000	2 3 1
Total	97,620,000	0 14 0
Worked at a loss:		LOSS.
Electricity supply	12,510,000	0 1 10
Harbours, piers, etc.	5,420,000	1 8 8
Burial grounds	2,380,000	2 13 6
Baths and washhouses	1,990,000	6 5 9
Working-class dwellings	1,250,000	2 3 0
Total	23,550,000	1 5 11
		PROFIT.
Grand total	121,170,000	0 6 3

Description of "reproductive undertakings."	Capital invested in each description of undertaking.	Average yearly amount set apart for depreciation of the plant, machinery, etc., represented by the capital in (a).	Percentage proportion of (b) and (a) per £100 of capital. Being the yearly amount set apart for depreciation per £100 of capital value.
	(a)	(b)	*Per* £100
	£	£	s. d.
Waterworks	56,940,000	27,266	0 11½
Gasworks	24,030,000	79,972	6 8
Electricity supply	12,510,000	19,970	3 2½
Tramways	9,750,000	50,307	10 4
Markets, etc.	6,180,000	500	0 2
Harbors, piers, etc.	5,420,000	4,499	1 8
Burial grounds	2,380,000	nil	nil
Baths and washhouses	1,990,000	nil	nil
Working-class dwellings	1,250,000	nil	nil
Other "reproductive undertakings"	720,000	10,760	30 2
Total	121,170,000	193,274	3 2½

Note.—The average yearly amount set apart for depreciation, which, in ordinary business, is a substantial item, is here so trivial that the amount of depreciation per £100 of capital value has to be stated in pence and halfpence, instead of in pounds sterling!

Description of "reproductive undertakings."	Capital invested.	Yearly loss on working, after setting apart for depreciation 5 per cent. on capital invested. Amount of yearly loss.	Per cent. of yearly loss per £100 of capital invested.
			Per £100
	£	£	£ s. d.
Waterworks	56,940,000	2,729,606	4 15 11
Gasworks	24,030,000	726,703	3 0 6
Electricity supply	12,510,000	617,237	4 18 8
Tramways	9,750,000	337,875	3 9 4
Markets, etc.	6,180,000	224,718	3 12 9
Harbors, piers, etc.	5,420,000	344,225	6 7 0
Burial grounds	2,380,000	182,784	7 13 8
Baths and washhouses	1,990,000	224,452	11 5 7
Working-class dwellings	1,250,000	89,478	7 3 2
Other "reproductive undertakings"	720,000	9,867	1 7 5
Total	121,170,000	5,486,945	4 10 7

Note.—The above losses should take the place of the alleged profits and losses which are arrived at by the process adopted by municipal corporations of immensely understating the yearly amount that ought to be set apart for depreciation, but which is not set apart by them.

It is to be noted, however, that even this absurdly low return is only reached by means of a depreciation account of the ridiculous sum of 3 s. 2½ d. per £100 of capital value (77 cents per $500), and Mr. Schooling then revises the data, with a reasonable amount for depreciation, the result of which comes out in the next table showing a percentage of yearly loss per £100 of capital invested, of actually £4.10.7 (i. e., about $22.50 loss yearly on every $500). In discussing this point Mr. Schooling says: "The way in which the corporations return their accounts is wholly misleading, and they put in their yearly depreciation amount at a figure which is sheerly ridiculous in order to be enabled to make out on paper a show of profit, miserable as it is, upon the various businesses they have undertaken." To clinch his point, Mr. Schooling presents the two diagrams shown in Figs. 1 and 2, illustrative of the hypothetical depreciation allowed by the authorities and that which really takes place and should be accounted for.

The net results are summed up as follows: "The facts shown

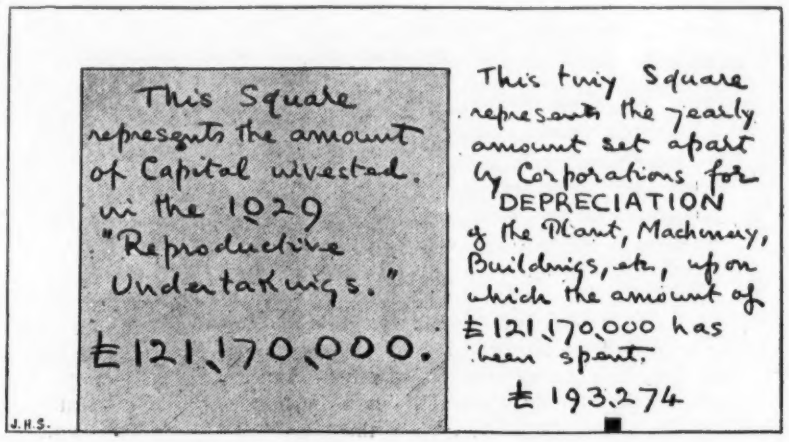

This Square represents the amount of Capital invested in the 1029 "Reproductive Undertakings."
£121,170,000.
This tiny Square represents the yearly amount set apart by Corporations for DEPRECIATION of the Plant, Machinery, Buildings, etc., upon which the amount of £121,170,000 has been spent.
£193,274
J.H.S.

FIG. 1.—DEPRECIATION ALLOWED ON ENGLISH MUNICIPAL PLANTS.

as to the continual piling up of debt, mainly for the purpose of working a vast number of businesses at a large yearly loss, is a most serious feature of local finance. It means among other things that the plant, machinery, etc., for which vast capital has been borrowed and spent, will be worked out in wear and tear long before the debt for it is paid off; and that other large debts will have to be contracted to make good the worn out plant, etc., thus adding a second

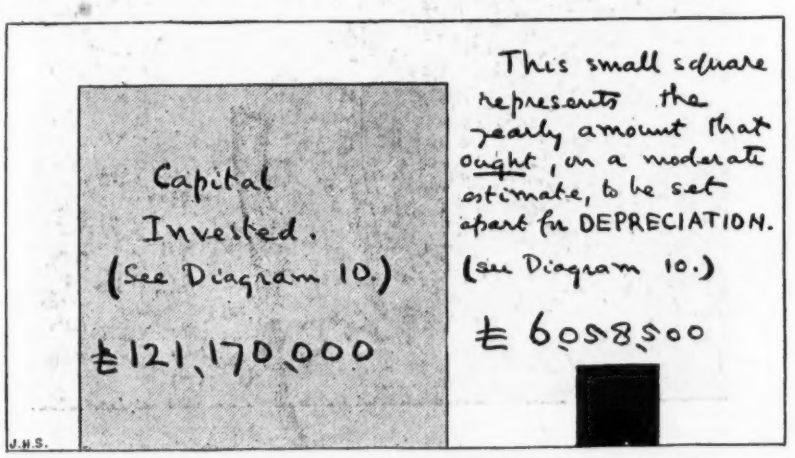

Capital Invested. (See Diagram 10.)
£121,170,000
This small square represents the yearly amount that ought, on a moderate estimate, to be set apart for DEPRECIATION. (see Diagram 10.)
£6,058,500
J.H.S.

FIG. 2.—DEPRECIATION THAT SHOULD BE ALLOWED ON ENGLISH MUNICIPAL PLANTS.

or even a third load of debt to local finance before the original debt is paid off."

It is hardly to be wondered at that Mr. Schooling has grave forebodings as to the future and says: "I maintain that the facts now disclosed prove beyond doubt that the local spending authorities of this country are utterly incompetent, and that they ought not to have the power to raise £112,000,000 yearly."

Electrical Equipment of New U. S. Battleship.

The electrical generating equipment of the United States battleships *Mississippi* and *Idaho*, now building, will consist of eight 100-kw, 125-volt units, disposed in two separate and independent dynamo rooms. The two 12-in. gun turrets and four 8-in. gun turrets will be operated electrically by the Ward Leonard system. The ammunition hoists for the turret and smaller guns will all be operated electrically. Electrically-operated conveyors will also be installed to transfer ammunition from handling rooms to hoists. All blowers, excepting those for forced draft wil be operated by electric motors. There will be 23 blowers for compartment ventilation. All boat cranes and deck hoists will be run by electric motors. A very complete system of telephones, call bells, buzzers, gongs, annunciators, engine and steering telegraphs, revolution and rudder indicators will be installed.

A Chinese Electric Railway System.

Situated near the mouth of the Canton River, and distant about 90 miles from the ancient Chinese city of Canton, is the little island of Hong Kong, the naval centre for England in the Far East. The island is some 11 miles long and from 2 to 5 miles broad, and has a population estimated at 284,000. Previous to the present year, the popular ricksha, drawn by a Chinese coolie, was the principal means of locomotion, and of these nearly 2,000 were licensed for hire, in addition to a large number owned privately. In 1902 an ordinance was passed by the Legislative Council of Hong Kong authorizing tramways to be laid down by the Hong Kong Tramways Electric Company, an English company, with its headquarters in London, and work was commenced in May, 1903, and completed last July.

Difficulty was encountered in the construction of the generating station on account of the fact that the best site available had been reclaimed from the sea only a few years ago, and consequently no good foundation could be obtained for either the buildings or the machinery. Piles were driven in such a way that they alone supported the whole weight of the building, the ground, which varied greatly in solidity, being left as an additional factor of safety. China fir poles, 15 ft. long and 5 in. in diameter were used for the buildings and machinery, special 7-in. poles, 18 ft. in length, being used for the chimney foundations. The chimney, which is circular, is built of brick, and is 153 ft. high. As Chinese

FIG. 1.—STREET VIEW, HONG KONG.

bricklayers are unaccustomed to this class of work, it presented greater difficulties in construction than any other part of the work, and as Hong Kong is subject to typhoons of noted severity, exceptional care had to be taken with both the foundations and the shaft itself. With the exception of the foundations and the chimney cap, the whole of the brick work is built in lime mortar of special composition, as is also the brickwork of the buildings.

On account of the varying nature of the ground, three forms of permanent way construction have been adopted. Where the ground was solid the rails were bedded on a concrete beam 18 in. wide and 6 in. deep; where the ground was not so good a bed of concrete 6 in. deep and 7 ft. 3 in. in width extending under the whole track and 1 ft. 6 in. on either side was adopted. Over doubtful ground, which had been recently reclaimed from the sea, this concrete bed was increased to 8 in. After the rails and the bottom concrete were in place the road surface was built up to rail level with concrete, and finished off with a smooth surface to the proper curvature of the road.

The lines within the city are for the most part of centre-pole construction, but the eastern portion of the route being outside the city boundary is laid as a single line. The overhead construction has been carried out in a very neat manner, the length of the arms on the centre poles not exceeding 2 ft., while the arms on the side poles vary in length, the majority of them being 6 ft. long. The poles are of mild steel, 28 ft. 3 ins. long, 7 in. in diameter at the base, tapering to 4 in. in diameter at the top. They are set in the ground in a solid block of concrete. Within the city, ornamental base castings add to the appearance of the poles, which is further enhanced by the addition of wrought-iron scrolls on the bracket arms. The total length of single track is 14½ miles, laid in 9¼ miles of route.

The trolley wire is divided into ½-mile sections by means of section insulators, and at each of these points the main feeder cables are tapped and current is taken to supply each section of trolley wire. This is accomplished by running the feeders through

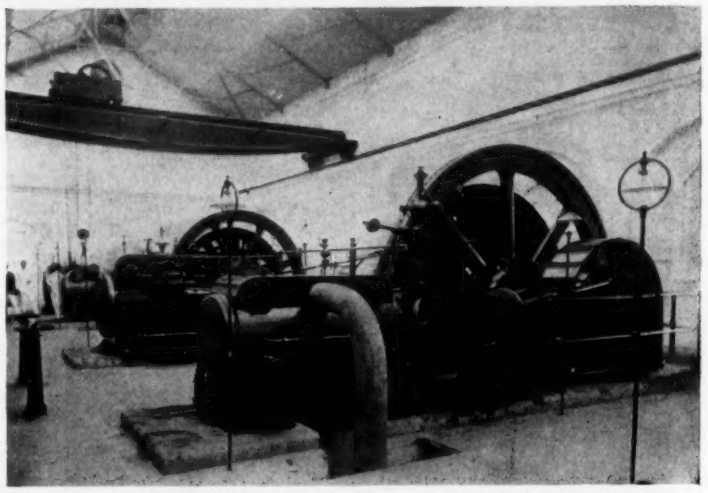


FIG. 2.—ENGINE ROOM, SHOWING TWO TRACTION SETS.

a feeder pillar containing the necessary switches and fuses the connections from the feeders to the trolley wires being made with rubber-covered cables carried up inside the poles, and along the sides of the bracket arms. There is provided in each feeder piller, a lightning arrester and also a telephone giving direct communication with the power house. In addition to the main feeders running east and west from the power station, a return booster feeder has been laid in each direction to within a mile of the two distant termini, where it is connected to the rails. It also makes connecton with the rails at each feeder pillar. A three-core pilot cable has also been laid from the power station to each terminus, one core being connected up for testing purposes, and the remaining two cores being used for telephone service.

As near as possible to the centre of the system is located the generating station. Within the engine room are placed two Dick-Kerr direct-current, direct-connected railway generators, compound

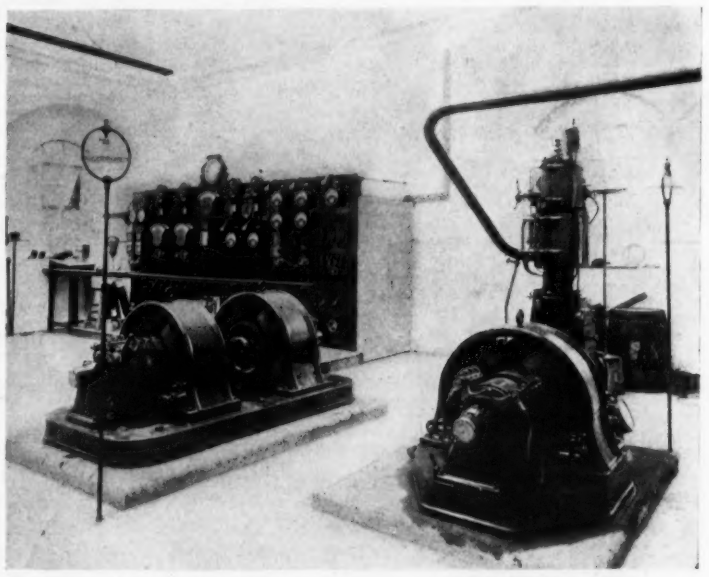


FIG. 3.—SWITCHBOARD AND LIGHTING SETS.

wound, running at 100 r.p.m., and giving 550 volts. The engines, built by Yates & Thom, are of the horizontal cross-compound type, each engine being equal to a maximum load of 557 b.h.p. The engines may be worked either condensing or non-condensing, a Wheeler surface condenser of the Admiralty pattern having been installed in the basement below the engine room. Circulating

water for the condensers is obtained from the Bowrington Canal, which is alongside the power house site. In addition to the two traction sets, there are two small plants for operating arc and incandescent lamps in the station, one set being driven by a small high-speed engine, and the other by a motor running from the 500-volt circuit. The lighting circuit is supplied at 100 volts pressure.

The boiler house contains two double-drum, water-tube boilers of the Babcock & Wilcox type, arranged to burn ordinary Japanese engine slack. Water is supplied to the boilers by two Blake & Knowles feed pumps, which take water from either a storage tank or a hot well, and feed the boilers either direct or through a Green economizer. Two feed-water filters and all water passes through one of these before entering the boiler.

The rolling stock consists of twenty-six, single-deck motor cars, sixteen of which are of the open, cross-bench type, the remaining ten being of the combination type with an enclosed portion in the centre and an open platform provided with seats at either end. The trucks are of the Brill type, equipped with Dick-Kerr 2A motors, the standard metallic shield blow-out controllers, and the usual hand brakes. The car bodies were built at Preston by the Electric Railway & Tramway Carriage Company, and were shipped to Hong Kong in sections, where they were fitted together and connected up in a very short space of time.

The detailed plans and specifications for this, the pioneer system of electric traction in China, were prepared by Alfred Dickinson & Co., of Birmingham. The contractors were Dick, Kerr & Co., of London, who carried out the whole of the work.

Development of the Unipolar Dynamo.

BY JAMES ASHER.

PROF. MICHAEL FARADAY, of London, in 1831, constructed the first unipolar dynamo. It was quite similar in appearance to Barlow and Sturgeon's unipolar electric motor, which had been invented a few years previously. Faraday's machine consisted in a circular plate of copper mounted in a horizontal shaft between the links of a U-shaped permanent magnet. One wire was flattened at the end and pressed against the circumference of the circular plate armature, while another wire pressed against the shaft. The points of contact of the wires were amalgamated. On mechanically rotating the armature there was generated an electromotive force which caused a current to flow either from the centre to the circumference of the armature, or the reverse, according to the direction of rotation of the disk. The presence of the current was made manifest by means of a galvanometer.

Not long after it was shown that most of those instruments which are intended to demonstrate electro-magnetic rotations will generate electric currents, when mechanically rotated. One of these consists of a straight permanent magnet mounted upright, with a pivot at each end, or pole. On passing an electric current into the cylinder, at either or both poles, and out at its middle through an annular trough of mercury, the magnet was set in rapid motion, thus demonstrating electromagnetic rotations. On mechanically rotating the magnet, an electromotive force was generated. The machine thus used was a miniature dynamo, while in the former case it was a miniature motor.

Werner Siemens devised and constructed a unipolar dynamo which consisted of a horizontal U electromagnet, round the poles of which two hollow cylinders of copper were caused to rotate, by means of belting or gearing. A second field magnet, having pole extensions, lay between the limbs of this magnet. The pole extensions nearly surrounded the copper armatures. These cylindrical armatures were longitudinally divided into sections, each of which was connected with a slip ring and one or more brushes, in order to increase the voltage of the machine.

Delafield designed a machine somewhat similar to that of Siemens. But in this machine the copper cylinders were not divided into sections. The electro-magnetic structure formed a consequent pole within each copper armature.

Professor Galileo Ferraris, of Turin, Italy, invented a unipolar dynamo in which two electro-magnets lay end to end with their similar poles in contact with each other. Within a cavity extending across the upper surface of the upper pole was the lower part of the armature. Within a similar cavity extending across the lower surface of the lower pole was another armature. The lines of force passed along the two shafts during part of their course.

Prof. George Forbes, of Glasgow, invented an iron-clad unipolar dynamo. A solid iron cylinder six by nine inches in dimensions, rotated within a thick hollow iron cylinder by which it was entirely enclosed. Two magnetizing coils were wound in grooves in the casing. One of these coils was wound opposite one of the rotating armature, while the other was wound opposite the other end. Brushes extended through holes in the casing, or field magnet, and pressed against the armature. This machine yielded thousands of amperes of current, but the pressure was only about two volts.

Prof. Crocker, of Columbia University, New York, in conjunction with Mr. Parmly, invented a unipolar dynamo. This consisted of two large annular electromagnets standing near each other in parallel vertical planes. The opposite poles of each electromagnet were very near each other. A large, thin iron ring rotated with its ends in the fields of the annular field magnets. The ring constituted the armature, from which the enormous current was led off by means of brushes at various points of the whole circumference.

Mr. Nikola Tesla devised a unipolar dynamo consisting of two U field magnets, having opposite circular poles near each other. Thus there were two magnetic fields. Within each magnetic field a disk armature was mechanically rotated. It is to be noted that the axis of each disc passed through the centres of two opposite poles. The armatures had diameters but little greater than those of the poles between which they rotated. Current was led from one armature to the other by a flexible copper belt instead of by means of brushes.

Mr. Heath, of the New England States, designed and constructed a unipolar dynamo. A yoke-wound field magnet had hollow cylindrical poles facing each other. The poles were uppermost, the yoke surrounded by its winding was near the floor. The hollow cylindrical poles extend some distance within, but not touching the hollow cylindrical iron armature. This armature may have a thin insulating coating on its outer surface, and a second armature may be slipped over it. The second armature cylinder, in like manner, may be lightly insulated on its outer surface, and a third armature cylinder may be slipped over the second. The second armature cylinder is shorter than the first, or inner cylinder in order that brushes may press against the first. Similarly, the third armature cylinder is shorter than the second, in order that the proper brushes may press against the second cylinder. Either one, two or three cylinders may be used. But if three are connected in series the voltage of the machine will be approximately three times as high as if only one armature cylinder were employed. The current, after traversing the armature, passes out at its middle and through the supporting web, thence along the non-magnetic shaft and away by means of brushes pressing against this shaft.

Wadsworth designed a massive unipolar dynamo having a vertical shaft. The two thin disc armatures were divided into sections, each connected with annular troughs containing mercury. Each trough had diameters approximately equal to the diameter of the field magnet which surrounded the armatures and shafts. The machine was of the iron-clad type. Its two armatures were mounted on one shaft, which was set vertical, because the designer used mercury in annular metallic troughs, instead of common brushes to lead off the electric currents.

Polecho's unipolar dynamo consists of a metallic disc slit radially into many sections. Two field magnets are used. Each stands diametrically opposite the other. Between the opposite poles of each field magnet the disc armature rotates. A hoop surrounds the thickened outer edge of the armature. Brushes press against the hoop in order to convey the electric current. Lord Kelvin invented a machine similar to this.

The unipolar dynamo yields an enormous amperage of perfectly steady value. It is simple. Its first cost is low. It occupies little space. On the other hand, it yields but a low voltage. It must be driven at very high speeds, and there is difficulty in taking off the current from the rapidly moving armature. Numerous brushes are required. These are subject to considerable heating and wear, and the loss of power, through torque of friction, is considerable.

For direct connection to steam turbines of high peripheral speeds, the unipolar dynamo possesses characteristics which seem to render it suitable to certain classes of work where there is required a large current at low voltage, such as in numerous electrolytic processes.

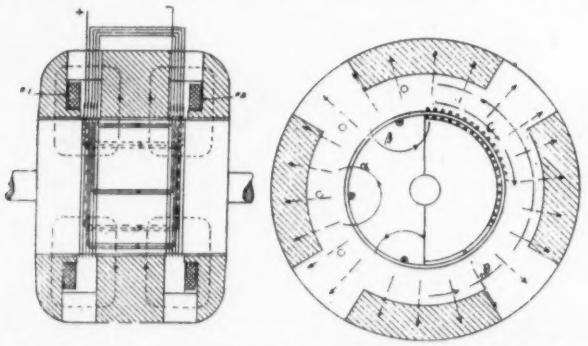
Unipolar Dynamos.

With the title "Acyclic (Homopolar) Dynamos," Mr. J. E. Noeggerath presented a paper at the January meeting of the American Institute of Electrical Engineers, which described a dynamo of the type generally known as unipolar, recently designed for the General Electric Company. Except for very low voltages, the author states that the so-called unipolar or homopolar dynamo has so far been a failure from a commercial point of view. This failure is ascribed as due principally to two conditions: First, the uncertainty as to the magnetic and electric conditions prevailing in this type of generator; second, the difficulties encountered in collecting large currents from a generator running at a high rate of speed. In order that the import of these conditions may be grasped there is described in outline the design of, and some results obtained with, a 300-kw, 500-volt turbine-driven acyclic generator built in the shops of the General Electric Company.

Classifying acyclic generators according to the position of the armature conductors, we find two prevailing types: (1) The radial type, having either one or two discs; (2) the axial type, having one or two cylinders, which may be either solid or hollow.

The armature of the cylinder type acyclic dynamo, considered in the paper consists (Fig. 1) chiefly of a solid cast-steel cylinder carrying a small number of straight conductors on its surface; these conductors are connected at both ends to sets of collector rings. The field, Fig. 1, consists chiefly of a cast-steel structure extending toward the shaft in three polar projections that enclose the armature in complete cylinders. Field coils, F_1 and F_2, are wound concentrically with the shaft. There are also mounted two sets of brushes and a number of stationary conductors (frame conductors). Eight openings give access to the brushes and field spools.

The field spools set up two primary fluxes shown in Fig. 2 as dotted lines, diverging radially. As the armature revolves in this uniform field there are generated in the conductors e.m.f's constant



FIGS. 1 AND 2.—SECTIONS OF CYLINDER TYPE MACHINE.

as to magnitude and direction. Single conductors or groups are connected in series by means of collector rings and frame conductors. At each end of each armature conductor is connected a collector ring upon which bears a brush serving to complete the circuit through the frame conductors and to the load independent of the position of the armature conductor. The currents passing through this system set up secondary fields which affect the primary flux. Of these the ones created by the currents flowing in the collector rings, producing ring reactions, are of great interest from a practical point of view. At any certain position of the brush on the collector ring with reference to the armature conductor, the current which flows from the armature conductor divides as it passes through the two paths formed by the sections of the ring, the branch currents being inversely proportional to the ohmic resistance of the ring sections. These currents set up fields in the magnetic material in which they are completely embedded.

As the armature revolves the point of contact between the brush and the collector ring moves on, changing the magnitude and direction of the two branch currents and the fluxes due thereto. These periodical changes of magnetization create hysteresis and eddy losses in the solid material.

Of the various means for counteracting ring reactions, the method which has given most satisfactory results is one in which the points of connection between the numerous armature conductors and the collector rings form a spiral of one complete turn while the contact points between the brushes and the rings form one or more turns of a spiral running in the opposite direction.

As to armature reaction, reference is made to Figs. 1 and 2. The current flowing in the armature conductors, C, sets up secondary fluxes, as indicated by the curved lines. These secondary fluxes cut the frame, as the armature revolves, causing hysteresis and eddy losses. They also increase the primary flux at α and decrease it at β. When the conductors are placed close together the radial components

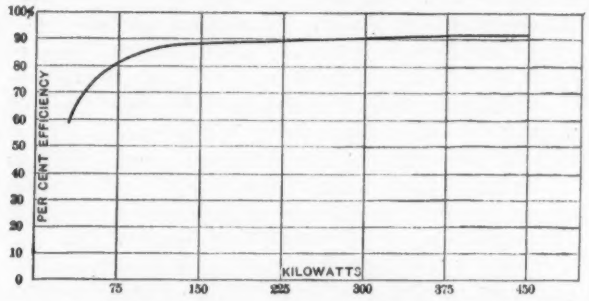


FIG. 3.—EFFICIENCY OF 300-KW, 500-VOLT ACYCLIC GENERATOR.

of these fluxes at α and β are neutralized. The most efficient means of conforming to this condition consists in using flat conductors mounted close together. The remaining unbalanced components of all the local fluxes form one circular field that intersects at right angles with the primary flux, Fig. 2. The neutralization of the ring and armature reactions as discussed above is very complete.

The efficiency of a high-speed acyclic generator about equals that of a turbo-driven commutator generator, but the distribution of the

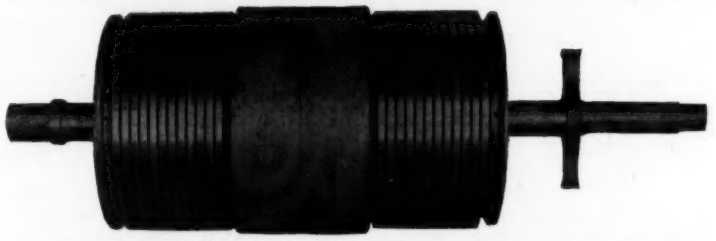


FIG. 4.—ARMATURE OF 300-KW, 500-VOLT ACYCLIC GENERATOR.

losses is very different. As windage and bearing friction depend upon the mechanical design only and not on the type, they can be made to have the same value for both machines. The field I^2R loss is somewhat smaller in acyclic machines, principally because the length of the air-gap is limited by mechanical requirements and not by the armature reaction. The I^2R armature loss is almost negligible on account of the small number of turns. In the generator under consideration, there are 12 armature and 12 frame conductors in series. The main losses are encountered in the brush contacts.

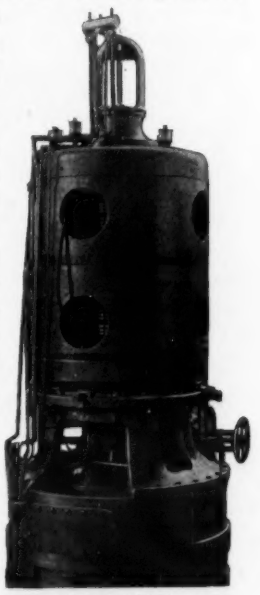


FIG. 5.—300-KW, 500-VOLT ACYCLIC TURBO-GENERATOR.

From a series of investigations, the following conclusions are drawn: (1) There is a steady but small increase of pressure drop at the brush contacts, with increasing speed. The friction loss, declining somewhat, remains practically constant for high velocity. The total losses also remain practically constant above these speeds. The improved ventilation inherent to greater velocity allows a higher current capacity to be used in the collecting system. (2) While the relation between current and pressure drop in stationary contacts of metal brushes and metal rings is similar to that in a solid resstance, the conditions in moving contacts are of the character of those prevailing in an electric arc, the apparent resistance falling off rapidly with increasing densities. (3) Increased brush pressure does not decrease the drop considerably, but the sparking tendency at high speeds and densities necessitates high pressure.

In the 300-kw, 500-volt turbo-generator the full load losses equaled 28 kw without windage and bearing friction. The efficiency curve, Fig. 3, is flat, due to the small core and brush friction loss. Regulation = 6 to 12 per cent.

Considering now the mechanical design, as mentioned above, the generator consists chiefly of a cast-steel armature and a cast-steel

frame. On the smooth armature surface are mounted 24 conductors, each being a flat sheet bent on the radius of the periphery. The torque is taken up by lugs projecting axially from the armature body and the centrifugal stress by means of steel binding wire. The 12 collector rings on either side of the armature (Fig. 4) are assembled close together and mounted on a shell. Eight large-sized openings in the frame (Fig. 5) give access to three brushes each, making a total of 24 contacts. The stationary circuit consists of 12 cables.

In comparing commutator and acyclic direct-current machines as to inherent conditions from a commercial point of view, the latter is essentially a high-speed machine, its field of application being limited in general to large turbo-generators, high-speed motors, direct-connected to rotary pumps and blowers, and to motor-generators. While the total weights of both types are about equal, even for moderate turbine speeds, the very low copper weight, simple construction—less labor and smaller total cost—combined with the elimination of commutating problems should speak favorably for the new type.

DISCUSSION.

In the discussion which followed the reading of the paper, Prof. F. B. Crocker stated that in May, 1894, he read a paper entitled "Unipolar Dynamos for Electric Light and Power" at the Philadelphia meeting of the Institute and that at that time he did not receive very much encouragement. The machine described by the author represents real progress, not a mere theory. The fact that it is a 300-kw machine and generates 500 volts shows that it is not apologetic in any sense. He thought that Mr. Noeggerath had given his hearers too much credit for knowing about this particular type. As a matter of fact it is the original Faraday disc. The type of machine is one in which the conductors, whether an element or the whole cylinder, revolve in an annular space in which the field is in one direction, and as nearly as possible of uniform strength throughout. Therefore, the e.m.f. is simply the number of lines of force cut per second divided by 10^8. Mr. Noeggerath has adopted the plan of splitting the cylinder longitudinally into strips, like the staves of a barrel, and connecting these in series. He has twelve turns, that is to say, twelve elements to his cylinder, 24 brushes, and obtains 500 volts, showing that he must obtain a high voltage from each of the elements. Mr. Noeggerath states that the regulation is good, and that the difference between full-load and no-load pressure is only slightly higher than the resistance drop, in other words, that the armature reaction is not excessive. It is interesting to learn that by merely moving the brushes forward or backward the conductors connecting these brushes with the circuit had the effect of a compound or differential winding. This important feature of the machine is well worth noting. In regard to the designation of the machine "unipolar" is not a happy expression, because it is not really significant. There are two poles, the flux passing across the air-gap from one pole to the other, so that the term unipolar is not particularly appropriate, but it is the one which has been in use for the longest time. "Acyclic" or non-cyclic is a very good expression.

Prof. W. E. Goldsborough thought that thanks were due to the author of the paper for having given such a clear and convincing discussion of a subject which has been a little too deep for a great many engineers. The paper will prove of especial value to a large number of designers, and to many educators who are compelled to attempt to answer many questions which are puzzling.

Dr. A. E. Kennelly pointed out that there had been opened a field in which the direct-current machine shows a distinct advantage. On account of the fact that no material has been found which would conduct magnetically and not electrically it has been necessary in the construction of dynamo-electric machinery to go to the expense of laminating iron in order to destroy eddy currents in the mass of the revolving armature. In the new acyclic machinery there can be used a revolving solid mass in which there will be no sensible variation of flux and no appreciable eddy currents. The secret of success with the new type of machine is due to the high speed obtained with the steam turbine, and there should follow a great reduction in the weight of the really active parts. It is noteworthy that the collector rings at each end have a combined surface, each of which is about the same as the surface of the armature proper, so that what may be called the commutator is twice as large as the armature itself.

Mr. Crellin Cartwright wished to emphasize the advantage of the acyclic generator over the ordinary direct-current commutator type of machine, especially for railway service, due to the absence of any commutator troubles. Moreover, due to the construction of the generator there is required only the simplest shop work, such as can be done on a lathe or boring mill, and having no complicated parts the new type of machine should possess considerable advantage as to cheapness.

Mr. F. N. Henshaw thought that a reduction of the surface speed at the collector rings would be of prime importance, since the voltage drops at the contact between the collector rings and brushes decrease with decrease of speed.

In reply to a question by Mr. Hatwood as to the composition of the collector rings and the wear on the brushes without lubrication, Mr. Noeggerath stated that the collector rings were of ordinary cast steel, though for mechanical reasons it would be better to have them of nickel steel. The wear on the brushes is not higher than on the carbon brushes of turbine-driven commutating machines. As far as core losses are concerned, blow holes in the cores are not a very serious proposition; in fact, holes have purposely been bored in the cores for ventilation. The openings in the frame produced core losses in the armature, and the openings in the armature produced core losses in the field. If the holes are placed a sufficiently great distance from the air-gap, the influence is not very strong.

The New Boston Edison Turbo-Generator Station.

In a paper read at the January meeting last week of the American Institute of Electrical Engineers, Mr. J. E. Moultrop described the new turbo-generator station of the Boston Edison Illuminating Company, of Boston. In designing this station the author said that the grouping of the apparatus had been given special attention and such care had been taken with their arrangement that they naturally come under the charge of the class of operators best fitted to care for them.

The turbine room has received all of the machinery in the station; even the boiler feed pumps, usually considered an adjunct of the boiler house, are treated as part of the turbine auxiliaries, and are placed in charge of the turbine operators. The boiler house contains only the boilers with the necessary piping, etc., so that the work in this room is to burn coal properly and to maintain the steam pressure. All of the electrical apparatus has been grouped together and installed in a separate building adjoining the turbine room, isolated from the noise and dirt of the latter, and free from liability of damage by accident to any of the turbine room machinery.

The apparatus is installed in the unit system. In the turbine room all the auxiliaries required for a generating unit are grouped around that unit, and are generally of sufficient capacity to serve that unit alone. The boilers necessary to supply the generating unit are in one room directly behind the turbine. In this way each generating unit is a small central station in itself. Practically no cross-connections are installed between the various units except that between each pair of units. The steam mains are joined by a small-sized tie, so that a generating unit can be run temporarily from the boilers of its mate, should an emergency require. In this way a very simple piping system is sufficient. The duplication of auxiliaries is eliminated, and should a generating unit be put out of commission by the failure of any one of its essential parts, it is intended that the entire unit will be shut down and another one started in its place.

The advantages of the turbine over the engine in first cost, the lesser amount of help required to operate, the ability to use condensed steam with safety for feed in the boilers, together with the fact that the apparatus takes very much less room, caused the turbine to be selected in preference to reciprocating engines, quite independent of the consideration of steam consumption, which is expected to be somewhat better with the turbine.

The turbines used in the first installation are of the Curtis type, with a rated capacity of 5,000 kw on a conservative temperature rise in the generator. They are four-stage machines, with surface condensers built in their bases, and are equipped with mechanical brakes for bringing the machines to rest for an emergency stop. In these features they are the first machines of their kind to be installed. The base condenser was adopted because it will give the best vacuum in the turbine.

The brake is very useful for emergency shutdowns, because the turbine will run for some hours with no load and no field, while with

the brake it is possible to bring the machine to rest in about five minutes. It also facilitates the overhauling of the step bearing by sustaining the weight of the rotating parts.

The step bearing on the turbine is lubricated by water instead of oil, because water is as good a lubricant for this purpose, it is cheaper and the lubricating system is simpler. The water is forced into the step under a pressure of about 1,000 pounds. As even a momentary stoppage of the water supply to the step would result in damage to the bearings, a motor-driven triplex pump, which can be started much more quickly than a steam pump, is installed as a relay to the main step pump. To obviate fluctuations in the pressure due to the pump's reversing its stroke, a weighted hydraulic accumulator is used. This is made of sufficient capacity to keep the step supplied with water for ten minutes, thus giving time either to shut down the turbine by means of the brake, or to put the relay pump in service should the steam pump fail.

All the switching apparatus with the exception of the excitation systems is remote-controlled. The controller panels with all the necessary instruments are grouped in the operating room in the form of a rectangle facing inward so that the operator can see at a glance any panel in the room. The excitation switch is hand-controlled. The excitation current is furnished by one small engine-driven set of capacity for all the engine-driven alternators, and three large motor-driven sets, one in each of the individual turbine rooms, with sufficient capacity to supply the turbines. In addition to the motor-generator sets, there is a storage battery with a capacity of 1,000 amp. for one hour floating on the excitation bus-bars. Besides the generator field coils there are fed from the excitation bus-bars a few other pieces of apparatus which are particularly necessary to the operation of the station, such as the motors operating the oil switches, the relay pumps for the step bearings, and a few lights around the station which would be essential in case the general lighting system should give out.

Simplicity and reliability has been the aim of the engineers throughout the work. Experimenting and the use of untried devices have been avoided. Special care has been taken to install apparatus which would operate continuously with a minimum cost of attendance and repairs, notwithstanding the fact that this would oftentimes largely increase the cost of installation.

DISCUSSION.

In announcing Mr. Moultrop's paper, President Loeb called attention to the fact that one of the main factors which enters into central station design, which is, perhaps, not always properly appreciated in the selection of machinery, is the effect of the load factor and the extent to which the maximum load or percentage of it is used throughout the year. In one of the largest electric light plants of this country it was found that of the total generating capacity, 10 per cent. is used for only 25 hours in the whole year, and all of these twenty-five hours come within the range of one month's operations. Twenty-five per cent. of the total power plant is used approximately 75 hours in the whole year, and practically all within two months of the year. It can be seen, therefore, that it does not necessarily follow that for this part of the equipment, which may be used for such periods of the year, the highest efficiency represents the highest commercial economy when investment costs are considered. This also is emphasized when it is considered that one-half of the total capacity of the power plant is used not over 500 hours in the whole year, and that all within seven months. These factors are of very great importance in the design of a power plant and must be considered in arriving at the best results, not only from a mere question of efficiency, but also efficiency of investment.

Mr. H. G. Stott thought that the load factor had been too frequently neglected. Our plants are probably too economical in the sense that they cost too much, and burn up interest, taxes and depreciation on investment more than outweigh the reduction in the cost of operating them. There is a point where the interest on the capital invested can be balanced against the purely operating cost and maintenance, to get the minimum cost per kilowatt-hour. The steam turbine is a move in the right direction, because there the investment is reduced probably 30 per cent. compared with reciprocating engine units of the same size. Engineers should demand apparatus with an enormous overload capacity, not necessarily economical at that overload, but apparatus which will easily carry 75 per cent. overload for an hour or so. Such apparatus could be obtained at a cost not greatly increased over that for the usual machinery. He believed that barometric condensers which can probably be had for $2 per kw would frequently prove more economical than surface condensers costing probably $8 per kw.

Mr. Bates in discussing the advisability of using condensed steam for feeding into the boilers showed that with a certain 5,000-kw unit for which $6,000 per annum is paid for boiler water, the saving of 90 per cent. of the steam would equal approximately something over two pounds of steam per kilowatt per hour under average operating conditions.

Mr. Philip Torchio pointed to the drawbacks of separating the electrical operating room from the engine room. The operator in charge of a station should have nothing to interfere with his seeing all that goes on, but when he is confined in a room entirely separated from the place where the current is generated, he cannot keep in touch with the plant. As to the subject of steam versus electrically-driven auxiliaries, there are hopes of obtaining steam turbine-driven auxiliaries. From numerous tests it has been demonstrated that a very slight increase in vacuum will increase the efficiency slightly. With jet condensers the high vacuum cannot be obtained, and the concensus of opinion abroad is that with steam turbines surface condensers should be used.

Mr. C. O. Mailloux mentioned the fact that in Europe steam turbines are used to drive feed-water pumps and that there is a great possibility in that direction when the pumps have been sufficiently developed, but that it is just as well not to attempt too much in the way of undue economy in the steam-driven auxiliaries, or resort must be had to some other source of heat for the feed water. He had no hesitancy in stating that he considered the Boston stations one of the finest and best designed that he had ever seen. Personal experience has shown that the jet condenser fails entirely for steam turbine work, the barometric condenser has better prospects of giving satisfactory vacuum, but there seems to be an element of chance about it, while the surface condenser seems best suited for this work.

Mr. W. F. White discussed the effect on other parts of the plant of using a surface condenser or a jet condenser, stating that since with the jet condenser outside feed water must be used, no benefit can be derived from condensation. This affects not only the economy of the station but also the cost of boiler repairs. Whether or not an economizer is advisable will depend upon the condenser installed, thereby affecting the total cost of the station from $5 to $10 per kw.

The Use of Sensitive Quadrant Electrometers.

At the recent meeting of the A. A. A. S., Prof. J. C. McLennan, of the University of Toronto, contributed a note on the use of sensative quadrant electrometers. In making measurements upon the conductivity of a gas by means of a highly sensitive electrometer such as the Dolezeleck type of instrument considerable delay and inconvenience was frequently experienced on account of the disturbance imparted to the needle by simply breaking the earth connection to the free quadrants. Even comparatively small oscillations imparted to the needle in this way require from half a minute to three or four minutes to subside, and this period, though not long, is still often quite sufficient to prevent observations upon the conductivity of a gas under specially interesting circumstances.

For example, in studying the decay of activity induced in a body by exposure under negative electrification to the emanation from radium, thorium or other similarly active substances, it is highly desirable to make observations on the intensity of activity as soon as possible after the exposure has ceased, and as any initial oscillations set up in the needle on breaking the earth connection must necessarily delay these until the initial stages of the decay of activity are past, it is most desirable to take every precaution to eliminate the disturbances as far as possible.

Such disturbances are in great measure due, as many experimenters have noticed, to electrostatic effects caused by the approach of the observer's body or even his hand, in the process of breaking the earth connection; and in order to avoid them it has become the practice to surround the electrometer and the testing apparatus with earth connected metallic screens, and also to make and break the earth connection to the quadrant by keys of a special form which the observer can operate from a distance by means of strings or other connections. In using different keys, however, Prof. McLellan found that with electrometers of high sensitiveness, small though relatively important initial disturbances still existed and

arose from a variation in the capacity of the measuring system caused by the action of the key itself when the earth connection was broken. In order to overcome this defect it was only necessary to take special precautions in the construction of the key to reduce this variation in capacity to a minimum.

With the modifications which are described below it was found possible when all parts of the apparatus were well screened to break the earth connection to the quadrants without any observable oscillations being set up in the needle. As a consequence, measurements could be made upon the conductivity of a gas at any instant with the greatest possible accuracy.

The general arrangement of apparatus adopted in measuring the conductivity of a gas is shown in Fig. 1. The receiver, *A*, which contains the gas whose conductivity is to be measured, rests on insulat-

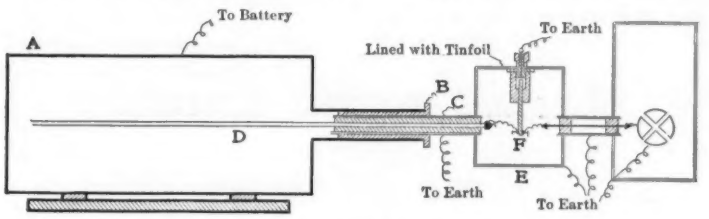


FIG. 1.—GENERAL ARRANGEMENT OF APPARATUS.

ing supports, and is connected to a battery of small storage cells. It is provided with an ebonite plug, *B* which carries an earth connected brass tube, C. This tube in turn also carries a second ebonite plug, which supports the exploring electrode, *D*. The tube, *C*, and the electrode, *D*, penerate a small wooden box, *E*, lined with tin foil also connected to earth, and connection is made at *F* with the contact key of special form. The electrometer is supported in a box of wood lined with tin foil connected to earth, and its free quadrants are connected to the key, *F*, by a wire supported by ebonite plugs in an earth connected brass tube, which at one end penetrates the box containing the key and at the other that containing the electrometer.

The key of special form is shown in Fig. 2, and consists of two brass parts, *A* and *B*, held by means of the ebonite support, *C*, with their parallel faces as close together as possible without touching. The whole is supported against the tin foil lining on the top

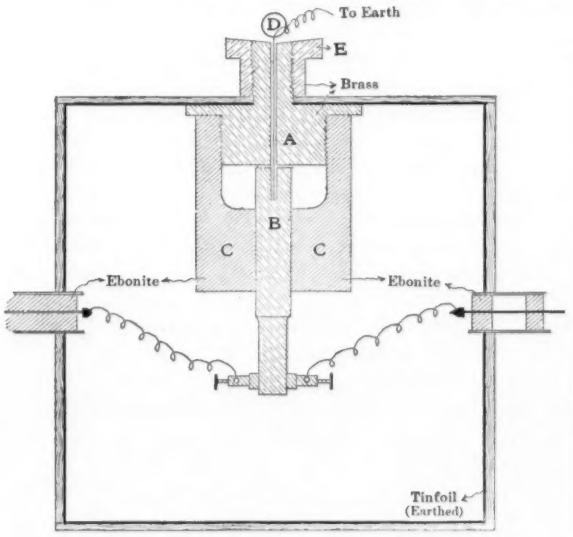


FIG. 2.—KEY OF SPECIAL FORM.

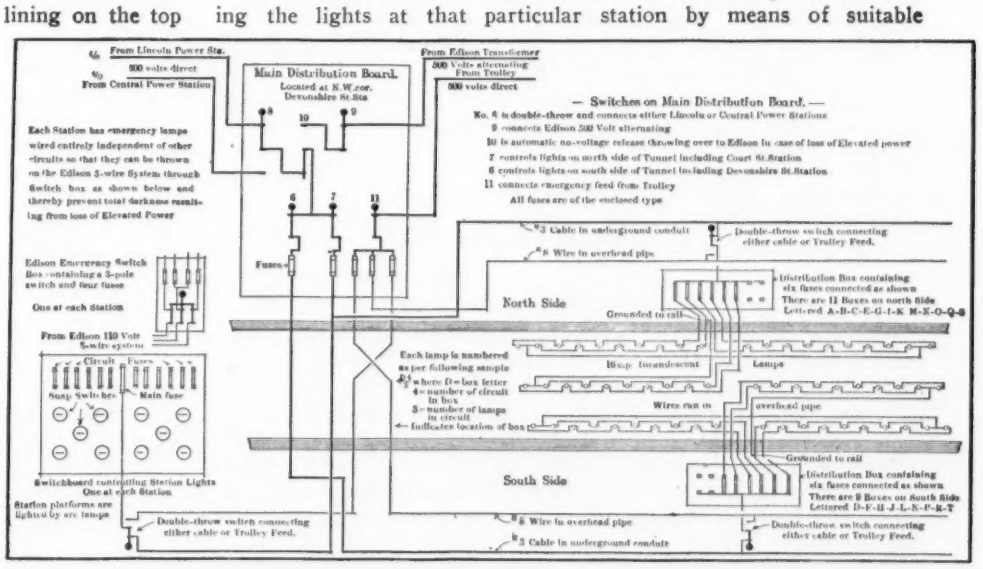
of the box by the nut, *E*, and this, of course, keeps the upper part, *A*, always connected to earth. Both parts, *A* and *B*, as shown in the figure are pierced by a small opening less than a millimetre in diameter and the earth connection to the quadrants is made or broken by inserting or withdrawing a fine rigid steel wire, *D*, which moves freely through this opening. The wire, *D*, may be tipped with platinum if desired, but in practice this precaution was not found necessary. It will be readily seen that with this device the earth connection can be broken with practically no variation in the capacity of the measuring system. By using this key and making the arrangements described above for screening off electrostatic induction it has been found quite immaterial whether the earth connection is broken by hand or by means of strings operated from a distance. In either case the process is not followed by any disturbance of the needle. All initial oscillations are entirely eliminated, and the needle, although starting from rest at the moment the contact is broken, almost immediately assumes a steady rate, and its motion may be taken as a measure of the conductivity of the gas at the instant the quadrants are freed.

The Lighting of the East Boston Tunnel.

In designing the lighting circuits for the recently completed East Boston tunnel, the point most kept in mind by the engineers was the importance of providing continuous illumination. The current for lighting may be drawn from three sources, namely, central power station, Lincoln power station and the Edison Electric Illuminating Company's system. Normally, the lights are supplied from Lincoln power station through a No. 000 B. & S. lead-covered rubber-insulated cable. The lamps may also be thrown upon the trolley circuit in the tunnel and fed from that, if desired. The trolley feeder, Edison, Lincoln and central power station lines are all brought to a main distributing board at the Devonshire Street station. The Edison current is drawn from a transformer as 500-volt, 60-cycle single-phase supply.

The accompanying diagram shows the general scheme of lighting. There are three rows of 16-cp, 110-volt incandescent lamps spaced 12 ft. apart throughout the tunnel. Switch No. 8 on the main distributing board is a double-throw knife switch, which serves to throw the tunnel lights upon either of the company's power stations. No. 9 is normally closed, so that Edison current will be instantly available in case the elevated supply fails. No. 10 is an automatic switch with two blades at right angles. It is fitted with a no-voltage release coil, which permits a powerful spring to throw the upper switch blade into the top jaw in case the current from the elevated power station should fail. When this occurs the lower blade is pulled away from the lower jaw to a horizontal position. The transfer of the tunnel lights is made so quickly by this switch that the eye does not notice the slightest flicker unless one is watching very closely and expecting the change.

At each station in the tunnel is a switchboard panel controlling the lights at that particular station by means of suitable


From Lincoln Power Sta.
500 volts direct
From Central Power Station
Main Distribution Board.
Located at N.W.cor. Devonshire St.Sta
From Edison Transformer
500 Volts alternating From Trolley
500 volts direct
— Switches on Main Distribution Board. —
No. 8 is double-throw and connects either Lincoln or Central Power Stations
9 connects Edison 500 Volt alternating
10 is automatic no-voltage release throwing over to Edison in case of loss of Elevated power
7 controls lights on north side of Tunnel including Court St.Station
6 controls lights on south side of Tunnel including Devonshire St.Station
11 connects emergency feed from Trolley
All fuses are of the enclosed type
Each Station has emergency lamps wired entirely independent of other circuits so that they can be thrown on the Edison 3-wire System through switch box as shown below and thereby prevent total darkness resulting from loss of Elevated Power
Fuses
3 Cable in underground conduit
Double-throw switch connecting either cable or Trolley Feed.
8 Wire in overhead pipe
Edison Emergency Switch Box containing a 3-pole switch and four fuses
One at each Station
From Edison 110 Volt 3-wire system
Circuit
Fuses
Snap Switches
Main fuse
Switchboard controlling Station Lights
One at each Station
Station platforms are lighted by arc lamps
North Side
Grounded to rail
Distribution Box containing six fuses connected as shown
There are 11 Boxes on north side
Lettered A-B-C-E-G-I-K M-E-O-Q-S
Each lamp is numbered as per following sample
where D = box letter
4 = number of circuit in box
3 = number of lamps in circuit
← Indicates location of box
16-cp Incandescent Lamps
Wires run on overhead pipe
South Side
Grounded to rail
Distribution Box containing six fuses connected as shown
There are 9 Boxes on South Side
Lettered D-F-H-J-L-N-P-R-T
Double-throw cutout connecting either cable or Trolley Feed.
8 Wire in overhead pipe
3 Cable in underground conduit
Double-throw switch connecting either cable or Trolley Feed.

LIGHTING CIRCUITS OF EAST BOSTON TUNNEL.

snap switches and enclosed fuses. Several arc lights are also installed at each station, and wired independently of the other circuits, so that they can be thrown on the Edison three-wire system through the switchbox shown in the diagram, thereby preventing the total darkness which might otherwise result from the loss of the regular power supply. At regular intervals in the tunnel distribution boxes are installed as shown, each box feeding six groups of five lamps each. On the north side of the tunnel are eleven such boxes; on the south side there are nine. Alternate lamps are fed from the same circuit. In each box is a single-pole, double-throw, knife switch for throwing the tunnel incandescents in that section upon either trolley, or regular elevated power. Each ticket office is lighted by two 116-cp incandescent lamps with frosted globes. All told, there are 600 incandescents in service.

Electrostatic Wattmeter

The electrostatic wattmeter has not found an extensive use in commercial work, because the forces which act upon the moving member of the instrument when connected up in accordance with the ordinary method are so small as to necessitate the employment of an instrument which is extremely sensitive and delicate. Under the ordinary practice, the voltage which is applied to the quadrants of the instruments is secured by passing the main current through a non-inductive resistance which necessitates the utilization of a low voltage in the instrument in order to avoid the large loss of power which would otherwise result in the non-inductive resistance.

In order to eliminate the objections to the use of large voltages, Mr. Miles Walker, according to a patent issued January 24, 1905, substitutes for the resistance, as a source of e.m.f. proportional to the load current and in phase therewith, a step-up series transformer, as shown in the accompanying illustration. A difficulty in

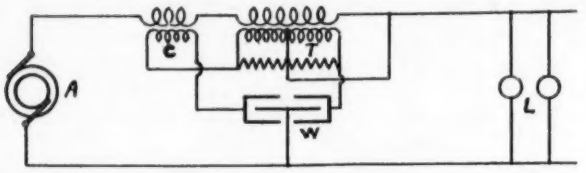


DIAGRAM OF ELECTROSTATIC WATTMETER CONNECTIONS.

using a plain series transformer in its simplest form is found in the fact that the e.m.f. measured across the open-circuited secondary coil will be perhaps 40° out of phase with the primary current, due to the predominating influence of the magnetizing component of the primary current. The inventor, therefore, places a non-inductive resistance across the secondary of the transformer, the effect being that the current which flows through the resistance in phase with the secondary e.m.f. necessitates an opposing component in the primary, and the resultant primary current is caused to be more nearly in phase (opposition) with the secondary e.m.f.

In order to shift the phase of the e.m.f. applied to the quadrants so as to bring it directly in opposition to that of the main line current, the inventor uses the compensating transformer shown at *C* in the illustration. This transformer has a core provided with a partially short-circuited air-gap so that its secondary e.m.f., which is added vectorily to the secondary e.m.f. of the main series transformer, *T*, may be in the proper phase position with respect to the primary current to compensate for the lack of exact phase opposition referred to above.

New Telephone Patents.

TELEPHONE SYSTEM.

Whenever a considerable territory is to be served from a single switchboard, if the common battery system is proposed for use, there arises a question as to whether a sufficient current can be furnished on long lines for efficient operation of the transmitters and signaling relays. In some instances these considerations have weighed so heavily against the common battery system that it has been abandoned, and the many subscribers near at hand have been forced to relinquish its many advantages because of the existence of the few at a distance.

In order to overcome such a contingency and take care properly of both classes of subscribers, Alfred Ekstrom, of Stockholm, Sweden, has brought out and patented a combination common battery and magneto system. With this, two kinds of relay devices are provided, to be associated at will with different sets of jacks. These sets of relays control the line and keyboard signals for complete supervision exactly similarly, but while one type, that for common battery working is actuated by the mere operation of the subscriber's switch hook, the other type becomes actuated by means of a magneto generator at the subscriber's premises. In this latter case a local transmitter battery is provided for each station. This provides for efficiency of transmission. Mr. Eckstrom has assigned his patent to Alstiebolaget L. M. Ericsson & Co., of Stockholm.

SENDER FOR AUTOMATIC SYSTEMS.

Messrs. John K. Norstrom and H. M. Graif, of Chicago, have jointly patented a sender for automatic telephone switchboards. This is so worked that the various actions necessary to send in a call follow each other in the natural sequence. To this end a user first removes his receiver, then sets the device to the desired number. Next he moves the calling handle to select and call the desired line. When a conversation is complete, the mere return of the receiver to the hook restores all the normal conditions.

A novelty of the apparatus lies in the arrangement of the code wheels so that the various digits of the desired number follow each other properly. Each wheel is set against a spring, and becomes latched by a pall controlled by the next preceding wheel. The call handle releases the first wheel. As soon as this has completed its rotation it unlatches the next wheel, and in the same manner this releases its successor, and so on. The Automatic Telephone Company, of Chicago, has obtained, by assignment, the patent for this invention.

LETTERS TO THE EDITORS.

Electric Omnibuses.

To the Editors of Electrical World and Engineer:

SIRS:—In reference to the note in your pages recently on "Electricity and Automobilism" (page 89), which is a quotation from Mr. Tesla's communication, 'Autobuses," to the *Manufacturers' Record*, I wish to make the following statement:

The practical advantages of an automobile actuated by an electric motor, the current for which is furnished by an engine-driven dynamo, mounted on the car, were recognized by a Vienese engineer, named Hertz, some years ago. These advantages, in his mind, were high speed and perfect control. Economy was a second consideration. In 1901 he designed an automobile of about 30 hp, incorporating the following features:

A gasoline engine was direct-connected with a direct-current generator and the current transmitted to a high-speed motor of very close regulation, mounted directly on the front axle. Both generator and motor were of the "compensated type" of Deri. (A very comprehensive description of Deri's machines is to be found in an article by Mr. F. Eichberg in the *Elektrotechnische Zeitschrift*, 1902.) This type is especially suited for the purpose, as it reduces the weight of the copper required, and therefore the total weight, to a minimum. The nearly perfect compensation of the armature reaction at all speeds and loads renders an absolutely fixed position of the brushes possible. It must be mentioned, though it is self-evident, that this fixed position is at the point where a practically sparkless commutation takes place. Thus very little care is required, and the wear of commutator and brushes is reduced to a minimum. This type has all the advantages of the direct-current equipment with disadvantages ameliorated as far as possible, and it must, therefore, be considered pre-eminently fit for this purpose.

The complete electrical equipment was designed and built by the Oesterreichische Union Elektricitäts-Gesellschaft in Vienna in the early part of 1902. I did not have an opportunity to witness the practical results, but have been informed that they were extremely gratifying.

CHICAGO, ILL. WM. LEDERER.

Schnectady Electrical School.

To Editors of Electrical World and Engineer:

Sirs:—The editorial in the issue of January 21 regarding the organization of an electrical school in connection with the Boston Y. M. C. A. was read with much interest by the writer. As we have in working order an electrical school of similar note in Schenectady, I thought that some of your readers might be interested in hearing of the course of study and of its organization.

The subject of an electrical school for working men was first suggested by Prof. R. Neil Williams, Associate Professor in electrical engineering at Union University, in an address given by him before the Labor Lyceum during the past summer. His hearers were so much interested in what he suggested that steps were immediately taken and a committee appointed to advise regarding the

formation of such an institution. The Board of Education and the officials of the Locomotive and the General Electric companies were interested, and an advisory board at last obtained, and early in September the school, which had been only a suggestion became a reality.

At a very enthusiastic meeting of young men in the High School Building of this city stirring addresses were made by various members of the Advisory Board and courses of study were outlined, and the young men were asked for their support. Immediately almost one hundred young men signified their intention of attending the school. They all fully realized the fact that it meant considerable work, as in outlining the course it was stated that omitting the languages and the higher branches of mathematics, the school was expected to cover practically the same ground in two years as is covered in four years' work at a college. This being the first year of the course, only the first year's studies were taken up, and we are now working in algebra, physics, electricity and magnetism and mechanical drawing.

The instructors, of whom Mr. A. M. Butler is director, consists of the following men: Messrs. H. P. Daniels and R. Williams in mathematics; Messrs. A. M. Butler, O. J. Ferguson and William E. Mitchell in physics and electricity, and Messrs. W. H. Frost and J. J. Mulcare in mechanical drawing.

Up to the present time there has been but a small falling off in attendance, and the interest which was taken at the first is still prevalent among the men.

The lessons are of considerable length, owing to the fact that one recitation period each week is given to each study, and these recitation periods are given to lectures by the various instructors and by experimental work in physics and electricity and magnetism. It is proposed to hold lectures in the auditorium of the school building at various intervals during the winter, at which men of note connected with the various manufacturing concerns are to lecture on their special subjects. Lectures have already been arranged for as follows: "Wireless Telegraphy," by Prof. R. I. Fessenden; "Static Electricity," by Mr. W. S. Andrews; "Light," by Prof. Opydyke, of Union College There are two other lectures scheduled for the course, one by a man from Cornell, and one by a man from Massachusetts Institute of Technology, who are to speak on "Mechanics" and "Electricity and Magnetism." The first lecture of this course is on Saturday, the 28th.

SCHENECTADY, N. Y. ALEX. M. FENWICK.

DIGEST OF CURRENT ELECTRICAL LITERATURE

DYNAMOS, MOTORS AND TRANSFORMERS.

Compounding of Alternators.—An illustrated account of Walker's new method of compensating and compounding alternators, which has been briefly noticed in the Digest. Some editorial notes are given on the subject, and it is pointed out that his method is quite simple compared with others where more or less complicated devices are employed. Walker's method has certain limitations and the more complicated alternatives still have a field of application all their own, notably in plants where the power factor is low or where the alternator is required to be highly compounded at full load. The new method is quite direct, and is based on the influence which the armature ampere-turns exert on the field ampere-turns. Every pole of the rotating field is to consist of two parts. The main part is provided with a magnetizing coil, which sends a large flux through this pole, keeping it well saturated. A small auxiliary pole branches off from the base of the main pole and extends radially to the outside diameter of the rotating magnet. This small auxiliary pole lies outside the field coil alluded to. Mr. Walker remarks that the small pole remains unmagnetized at no load, but the writer of the editorial note thinks that at no load it has a polarity which is opposite to that of the main pole and partially counteracts its effect. When load is put on the alternator and the current is approximately in phase with the e.m.f., the armature current above the field poles acts as a cross-magnetizing current, weakening that part of the field coil which passes between the main and the auxiliary pole, but strengthening the opposite part of the field coil. The magnetomotive force which causes the auxiliary pole to be opposite in polarity to the main pole diminishes as the armature current increases, and after the armature current has reached a certain value both poles act in the same direction. All the while the e.m.f. of the alternator has increased and machines of 150 kw capacity have, it appears, already been built on this principle, which possesses the property of overcompounding to a considerable degree. It is at once clear that, with increasing phase differences between current and electromotive force, the action of the armature current on the field flux will diminish. This, of course, is a disadvantage of the method, but it is pointed out that in most practical cases the power factor is at its maximum at full load, i. e., precisely when the maximum degree of compounding is required.—Lond. *Elec.*, January 13.

Alternating-Current Commutator Motors.—LATOUR.—A theoretical article discussing the phenomena of commutation during the starting period of alternating-current commutator motors.—*L'Eclairage Elec.*, January 7.

Zone Dynamos.—FLYNN.—Some critical remarks on the zone dynamo which was described some time ago in the Digest. The author agrees that it may be possible with this construction to get a higher capability of overload with good commutation, although he attributes such a result to other reasons than the inventor's.—*Elek. Zeit.*, January 21.

Commutators.—An article on the burning out of commutators, owing to the saturation of the V-mica with oil, and on the different ways in which oil may find its way to the mica insulation.—*Elec. Club Jour.*, January.

POWER.

Electric Driving of Textile Mills.—WOODHOUSE.—An illustrated paper read before the Leeds section of the British Institution of Electrical Engineers. The preparation of animal or vegetable fibres involves a very large number of operations, and owing to the delicate structure of the fibre the amount of work done on it in each machine is small; it is therefore readily understood that the power required to drive the machine unloaded is a large percentage of the total required. Mechanical transmission of power from a main engine to the various machines by means of ropes, belts, gearing and shafting involves a steady loss of power, which is very little reduced by the stoppage of individual machines. In a number of mills, which the writer has tested, the average efficiency at full load is 50 per cent., the lowest 34 per cent., and the highest 70 per cent.; in all these cases the loss of power in the main engine being included. These losses, serious enough at full load, are practically constant, and so the efficiency rapidly decreases as the load becomes less. The steady loss in transmission has an important bearing on the variation of load on the main engine or source of power supply. The author gives diagrams showing variation of load in actual cases and gives figures for the power required by spinning machines, self-acting mules (cotton), weaving, carding, scouring machines and in milling woolen cloths. He thinks that the advantages attendant on electrical driving are but partly gained if electrical transmission is adopted in the mill and the main engine or engines retained. He therefore recommends to buy the current from a supply company. The effect of electrical driving on the general arrangement of a mill is to allow the various machines to be arranged in the natural order of the processes without reference to the position or direction of shafting. In the majority of textile mill operations constant speed is of vital importance. This points clearly to the use of polyphase motors in preference to direct-current machines. The only important class of variable-speed machines is found in textile printing.—Lond. *Elec.*, January 6.

Engine Building Plant.—A fully illustrated description of the works of the William Tod Company at Youngstown, Ohio.—*Iron Age*, January 5.

TRACTION.

Neufchatel.—REYVAL.—An illustrated description of the electric tramway system of the city of Neufchatel, in Switzerland. The sys-

tem consists of five lines of a total length of 16 miles. The current is supplied at 600 volts for the whole network from the direct-current central station of the city, while two lines may also be supplied from another water power station. The equipment of the line and of the cars is described and illustrated.—*L'Eclairage Elec.*, December 31.

Tramway Motor.—An illustrated description of the construction of the Peebles tramway motor in use on British roads.—Lond. *Elec. Rev.*, January 6.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

German Central Station Statistics.—The yearly statistics of German central stations comprising a very vast amount of information on 32 full pages, the different cities being arranged alphabetically and various details of installation being dealt with in 12 different columns. The present number of central stations in Germany is over 1,100, but the statistics cover only 1,028 plants and refer to the status at April 1, 1904. Only those plants are included which sell current to consumers or supply public lighting, while isolated plants are not included. In 1904 there were 51 plants in Germany of a capacity of more than 2,000 kw. The three largest plants are three Berlin stations of 85,136, 30,000 and 25,895 kw respectively. The total capacity of the 51 stations of more than 2,000 kw is 290,693 kw, these stations being in 33 cities. The development of central stations and their connections in Germany in general is shown in the following table:

	1894	1900	1904
Number of stations	148	652	1,028
No. of 50 watt incan. lamps connected..	493,801	2,623,893	5,687,382
No. of 10 amp arc lamps connected....	12,357	50,070	110,856
Horse-power of motors (not incl. trac.)	5,635	106,368	263,036

In recent years several plants have been erected which supply current to a number of cities and towns in a district; thus the Bruehl central station supplies current for lighting and power to 66 towns at a distance of from 9 to 12 miles from the station. On the other hand, there are some small plants which supply current for power purposes to houses for the support of house industries. A typical example is the Anrath plant near Crefeld. All the motors connected to the mains are in this case between ¼ and ½ hp and are used in the silk industry. In recent years the use of power has enormously increased, as is shown in the following table of comparison between the kilowatts used for lighting and for power, traction motors not being included in the latter case:

	Kw. for lighting.	Kw. for power.	No.of motors.
1885	250	.....	.....
1890	3,899	112	28
1895	10,752	2,252	663
1900	21,122	22,037	5,764
1904	36,195	44,448	12,933

There is only one plant in Germany which buys energy in bulk from a larger works and sells it in retail to consumers; this is the Spandau station, which gets the current from one of the Berlin works. Statistical data concerning the systems used are given in a following table:

	No. of works.	Kw. of machines.	Kw. of batteries.	Tot. capacity in kw.
Direct current with storage batteries..	803	175,263	69,957	245,220
Direct current without stor. batteries	40	2,346	.....	2,346
Alternating cur., single ph. and 2 ph.	41	37,317	400	37,717
Three phase current	63	69,054	1,532	70,586
Monocyclic system	2	1,030	152	1,182
Mixed three phase and direct current	64	141,330	23,169	164,499
Mixed alternating and direct current .	15	8,542	855	9,397

Concerning the power used the statistics show that 570 plants with 341,248 kw use steam power, 109 plants with 14,547 kw use water power, 208 plants with 60,672 kw use both steam and water power, and 94 plants of 10,050 kw use gas power.—*Elek. Zeit.*, January 12.

Rise of Potential on Transmission Lines.—SEIBT.—An article, illustrated by diagrams, in which the author develops a theory of the rises of voltage in transmission lines due to certain closing or opening of the circuit whereby oscillations are produced. He deals especially with the damping of the oscillations and shows that the rise of voltage depends on the damping. He suggests a device for protecting the line against such voltages in which the quick variations of current are used to produce an auxiliary potential which facilitates the discharge through the air-gap, as shown in Fig. 1. *H* is a spark-gap of the well-known horn type. *A* is the primary and *B* the secondary coil of a small transformer. The secondary is connected to a Geissler tube. This tube will be dark during normal operation, since the slow oscillations of the supply current are not sufficient to produce any considerable e.m.f. in the secondary coil, *B*. But when the quick oscillations causing the increased voltage set in, a considerable e.m.f. is induced in coil *B* and the Geissler tube is lighted. The

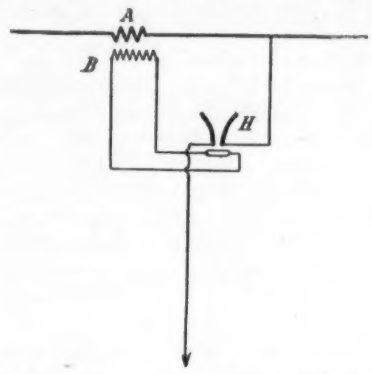


FIG. 1.—RISE OF POTENTIAL ON TRANSMISSION LINES.

ultra-violet light falls on the air-gap, diminishes its resistance and thus facilitates the passing of the discharge.—*Elek. Zeit.*, January 12.

Subdivision of Voltage in Alternating-Current Plants for Osmium Lamp Installations.—EHRENTRAUT.—An illustrated description of a method used by the Osmium Lamp Company for dividing the voltage of the mains so as to supply low-voltage osmium lamps. Other purposes of the arrangement are to enable one to switch on or off any one of the group of osmium lamps connected together to the mains and to prevent the loss of energy in the coil ("divisor") from which the different lamps are separately supplied. The divisor is the coil connecting *K* and K_1 in Fig. 2. *G* are the osmium lamps, *S* are

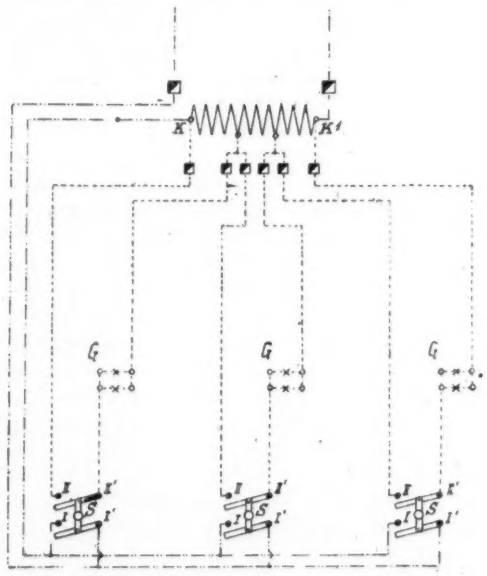


FIG. 2.—DIVISOR FOR OSMIUM LAMPS.

switches. It will be seen that by means of each of these switches the corresponding osmium lamp is connected to the circuit and that when all the lamps are switched off no current flows through the divisor coil, so that there is no loss at no load.—*Zeit. f. Elek.* (Vienna), January 8.

High-Tension Switch Gear.—ANDREWS.—A paper read before the Manchester section of the British Institution of Electrical Engineers. While the necessity of some type of remote control is generally recognized, considerable difference of opinion exists as to whether it is best to effect this operation electrically or mechanically. The author seems to be more in favor of mechanical control. He does not think it advisable in all cases to place the operating switchboard in the engine room; where the attendant's only duty is to manipulate the switches, the author is in favor of placing him in a position where he will be guided in his operations solely by the reading of the indicating instruments and will not have his attention distracted. Concerning the question whether it is necessary to separate the contacts of one phase from those of opposite phases in the main circuit-breakers, he concludes that all that is actually required is that the contacts of the different phases should be contained in separate oil tanks, the latter being insulated from the high-tension connections and from earth. Neither fuses or excess current circuit-breakers should be used between generators and the main bus-bars, but re-

verse-current circuit-breakers should be used in this position. Concerning the use of discriminating cut-outs or reverse-current cut-outs he gives the following rule: Where current is fed into bus-bars from a number of sources of supply connected in parallel, discriminating cut-outs only should be used. Where current leaves bus-bars to supply a number of feeders, transformers, motors or distributors, excess current cut-outs only should be used. Concerning the question whether a discriminating cut-out should operate instantaneously or possess some time element, he thinks that on the whole the advantages are on the side of instantaneous action. High-tension fuses for controlling circuits carrying large currents are now being almost exclusively replaced by excess-current circuit-breakers.—Lond. *Elec.*, December 30.

Switchboards.—PECK.—A continuation of his serial on modern practice in switchboards. He first gives the general characteristics of the machines and circuits to be controlled and which must be understood by the operator of the switchboard. He then describes modern direct-current switchboards.—*Elec. Club Jour.*, January.

WIRES, WIRING AND CONDUITS.

Calculation of Electric Lines.—ROSENBAUM.—An article, with diagrams, on an approximate method for calculating electric lines for a given loss of power.—*Zeit. f. Elek.* (Vienna), January 1.

ELECTROPHYSICS AND MAGNETISM.

Coherers.—FISCH.—A long account of an experimental investigation of coherers. He first studied coherers with multiple contacts and then coherers with a single contact. The results are given in numerous tables and the main results may be summed up as follows: A multiple-contact coherer is more strongly influenced by alternating current than by direct current, and its resistance is reduced by very small (effective) alternating e.m.f's. The resistance of a single-contact coherer with a layer of oxide or a dielectric liquid varies with the strength of the current. The curve which gives the potential difference at the terminals as function of the current shows three distinct parts. First, the potential difference increases up to a determined certain value ("equilibrium voltage"). Then the potential difference remains constant for a certain interval, while the current increases. Finally, the potential difference increases again. There exists not always a critical tension in the sense in which Robinson uses this term. The equilibrium voltage depends on the conditions of the contacts and the dielectric. The initial higher resistance is reproduced in part as long as the equilibrium tension is not surpassed.—*L'Eclairage Elec.*, December 31, January 7.

New Photographic Method for N-Rays.—BORDIER.—A description of a method of registering N-rays which is not open to the objections urged against the spark method, and at the same time gets rid of the difficulties attending the occular observation of the effect upon a fluorescent screen. The author uses a calcium sulphide screen, but instead of observing the increase of luminosity under the action of N-rays direct, he records it photographically by a prolonged exposure. On a thick piece of paper he places two groups of collodion drops containing a little of the sulphide in suspension. These are allowed to dry and are kept in the dark over night. The paper is then exposed for five or ten minutes to dull daylight, and is then placed with the drops underneath, on a photographic plate enveloped in tissue paper. It is left in the dark for 24 hours, a source of N-rays, such as a file, being placed over one group of patches and a piece of lead of the same weight and the same outline being placed over the other group. After this prolonged exposure the plate is developed. It shows a number of black patches corresponding to the drops, each surrounded by a halo. But in every case the halo surrounding the patches covered by the file is larger than that surrounding the patches covered by the lead. In another experiment a cardboard box containing pieces of tempered steel was substituted for the file, and another box containing an equal weight of lead was submitted for the lead block. Exposure was made as before, and the plates were sent to the director of the photographic laboratory of Lyon University for measurement. His measurement showed that the patches produced under the steel had a diameter of 6.4 mm. and a halo of 11.7 mm. in diameter. The other patches had an average diameter of 7.1 mm. and a halo of 10.8 mm. Therefore, the patches exposed to the N-rays, although having a photographic image of smaller diameter, produced a wider halo. The author describes a further experiment, which is even more conclusive. A line of sulphide is traced on paper with a capillary tube containing the emulsion. After drying, the line is cut in two, and the halves are exposed to lead and tempered steel, as above. On developing, the image from the steel appears first, and its edge is shaded by a wider halo.—Lond. *Elec.*, December 30; from *Comptes Rendus*, December 5.

Electric Discharges Through Gases.—KIRKLEY.—The author has formerly made experiments which exhibited the effect of passing electricity with a luminous discharge through hydrogen and oxygen, mixed in equivalent proportions and at low pressures. The experiment showed that a partial union of the gases into water vapor is the result and that if the pressure and the potential difference remains constant, the quantity of water vapor formed is proportional to the coulombs which have passed. The author has now extended his investigations in studying the influence of the change in the distance between the parallel electrodes and the influence of the nature of the electrodes.—*Phil. Mag.*, January.

Evacuation of Vacuum Tubes by the Current.—RIECKE.—In the course of a study of discharge phenomena in vacuum tubes, the author noted that the pressure in the tubes seemed to fall of itself. This phenomenon is similar to the "hardening" of Röntgen tubes. In one case the pressure fell from 0.252 mm. to 0.083 mm. A further inquiry showed that the fall in the pressure was altogether due to the passage of the current. Careful measurements made with a charge of nitrogen showed that a current of one electromagnetic unit absorbs 0.97 milligrams of nitrogen per second between the pressures of 0.1 and 0.075 mm., and 0.398 milligrams between the pressures of 0.044 mm. and 0.030 mm. If every atom of nitrogen were attached to an electron, only 11 per cent. of the current would be conveyed by the nitrogen ions in the first case and 27.6 per cent. in the second case. The author also describes the formation of Newton's rings on the cathode and rings on the wall of the tube which accompanies this conduction by nitrogen.—Lond. *Elec.*, January 6; from *Annalen der Physik*, No. 15.

ELECTROCHEMISTRY AND BATTERIES.

Sterilization of Water by Ozone.—KERSHAW.—The conclusion of his article in which he describes the sterilization plants at Martinikenfelde, Wiesbaden and Paderborn in Germany. His conclusions are that the use of ozone for water purification and sterilization has emerged from the experimental stage of its development, and that under certain conditions this method of purification can be operated with successful results—both commercially and otherwise. The conditions required to make such an installation a success, however, are exceptional, and it seems unlikely that ozone, or more correctly, ozonized air, will be employed on a very extensive scale for sterilizing the water supply of great cities. In small towns and villages, where the initiation of large water works schemes is impossible owing to the financial outlay involved, the ozone treatment for purifying and sterilizing an impure water supply near at hand, would seem to have a future field of usefulness. The purification of water by ozone would also appear to have a future in works where drinks and beverages of all kinds are manufactured for public use, and possibly also on board ships and in military camps, where the necessary supply of steam or electricity for generating the current can be obtained. Since the theoretical yield of ozone per electrical hp-hour is stated to be 1,000 grams, and the maximum yet obtained is 184 grams, or an efficiency of only 18.4 per cent., there is still ample room and opportunity for improvements in ozonizers.—Lond. *Elec. Rev.*, January 6.

Fixation of Atmospheric Nitrogen.—A note from the Siemens & Halske Company stating that the calcium cyanamide process is no longer merely a laboratory experiment, but is now being worked in Berlin on a fairly large scale. In addition, an Italian company is building a plant which will have an output of 4,000 tons a year. It is said to be an established fact that calcium cyanamide can be used as a fertilizer instead of nitrate or ammonium sulphate. There are two processes for producing cyanamide, one starting with calcium carbide, while in the other process the nitrogen is fixed by heating lime and carbon in a stream of air in a resistance furnace.—Lond. *Elec.*, January 6.

Tin Paste.—GELSTHARP.—A Faraday Society paper on the electrolytic preparation of tin paste. The author uses a dilute solution of hydrochloric acid as electrolyte with tin anodes. By using a very high current density, hydrogen is deposited at the cathode simultaneously with the tin and the latter goes down in spongy form.—Lond. *Elec.*, December 23.

Measurement of Electrode Potential in Stationary Liquids.—Sand.—His illustrated recent Faraday Society paper in full, an abstract of which was recently noticed in the Digest.—*Phil. Mag.*, January.

Units, Measurements and Instruments.

Potentiometer.—Campbell.—A description of a multiple-dial potentiometer, in which a thick slide wire of circular form is in series with a serial of a hundred coils. *V* is the voltage to be measured and the method of measuring is the usual one, by means of balancing against a standard cell. The special feature is that the hundred coils are arranged in circular form, contact being made by a revolving lever, but in order to prevent clumsiness the hundred and one studs are not arranged in one circle, but in two sets, as shown in Fig. 3, at *C* and *D*, the last stud, *F*, on dial *C* being connected to the turning head of dial *D*. The author uses an interlocking arrangement, so that the second slider remains locked at its zero position until the first slider is turned to the stud, *F*.—Lond. *Elec. Rev.*, December 22.

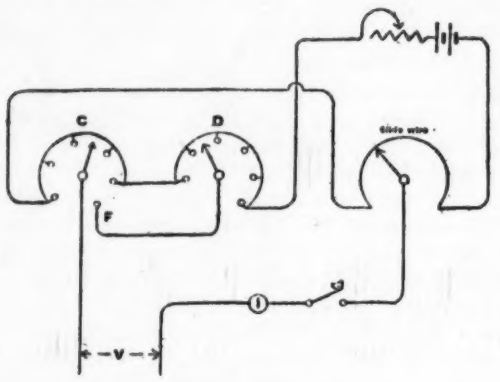


FIG. 3.—POTENTIOMETER.

Photometry for Central Station Engineers.—Wild.—An article urging the necessity of making photometric tests of incandescent lamps supplied to consumers by central stations. The author describes how to carry out quickly and accurately photometric measurements in a station, without employing any very expensive apparatus, nor a specially skilled testing staff. He first discusses the light standard for which he recommends a standardized incandescent lamp. He then describes the photometer bar and the comparison box, and the electrical instruments and regulators. He finally discusses the direction in which candle-power should be measured and the effect of stray light and reflections.—Lond. *Elec. Rev.*, January 6.

Meters.—Gerhardi.—The first part of a serial on electricity meters. The author makes some introductory remarks on the classification of meters and then describes the operation of alternating-current meters based on the action of an alternating magnetic field on a disc or cylinder.—Lond. *Elec.*, January 6.

Meter.—Trouilhet.—An illustrated description of the Aron watt-hour meter.—*L'Eclairage Elec.*, December 24.

Telegraphy, Telephony and Signals.

Wireless Telegraphy in Dutch Colonies.—A note stating that the second chamber of the Dutch Parliament has voted against the erection of wireless telegraph stations in the Dutch East Indies by the Government. There will now be granted franchises to a private company, which will have a free hand in selecting the system.—*Elek. Zeit.*, January 5.

Miscellaneous.

Patents.—A list of interesting English patents which will run out in 1905.—Lond. *Elec.*, January 6.

Berlin Electrical Society.—A full account of the speeches held at the recent twenty-fifth anniversary of the Electrical Society of Berlin.—*Elek. Zeit.*, December 15.

Engineering and Industry.—Von Halle.—A long paper read before the Berlin Electrical Society on the relation between inventions in Engineering and their commercial exploitation.—*Elek. Zeit.*, December 8.

Electricity in the Manufacture of Perforated Music.

Electricity has recently become the principal agent in the production of music by mechanical means. The mechanically-operated piano and the paper music rolls have long enjoyed a considerable degree of popularity which was until lately limited, however, by the fact that through the use of the old style rolls the music produced was too mechanical; that is, it did not display the desirable qualities of music played by the human piano performer. An active investigator led to the method of cutting the rolls electrically.

The process, of which the electrical cutting machine is the central feature, is now worked on a large scale at the plant of the Perforated Music Roll Company, almost within the shadow of the great works of the General Electric Company, at Schenectady, N. Y., the engineers of which company have contributed largely toward eliminating some of the initial difficulties.

The "raw material" consists of a special grade of thoroughly seasoned paper, which is cut with extreme accuracy to the desired width. The "copy" consists, for instance, of a selection of the latest comic opera success, in the ordinary form of music prepared for the human player. The piece of music first goes to the musical director, who supervises the laying out of the master roll. He examines the music with a view to deciding to what extent it can be faithfully copied and what alterations must be made to meet the requirements of the mechanical piano player. For example, where a note is to be repeated allowance must be made for the time necessary for the closing of the valve in the piano player. Then again, if the "mechanical" qualities are to be eliminated, due consideration must be given to the limitations of the human performer. For instance, if a chord

FIG. I.—LAYING OUT THE MASTER ROLL WITH RULE AND COMPASS.

at one end of the keyboard is to be struck immediately after one at the other end, an appreciable interval of time will elapse while the hands of the human performer are moving from one end to the other. Such an interval should, therefore, be provided for in laying out the music roll. Then again, the refrain is repeated by the human player with considerably more animation than when it is first played, and the proper alteration must be provided, such as strengthening the notes with an octave when repeating the refrain. There are a number of other similar changes which suggest themselves to the trained musician and to one who understands the construction of mechanical piano players.

Such refinements are employed in devising the master roll only because it is possible to duplicate them completely in the rolls, which are to be made in quantities therefrom. The electrical process of cutting permits of perfect duplication. The old mechanical-pneumatic processes were not sufficiently subtle to give effect to such careful planning. The musical director having made certain pencil marks on the sheet of music as received from the publishers, the "copy" has been "edited." He now turns it over to an assistant, who "lays out" the master roll. The assistant sits before a table (Fig. 1) on which a foot or two of a blank music roll is exposed. This roll is wound on a spool and a fresh surface is reeled into place as needed. Suppose that the music is in ¾ meter and it has been convenient to allow three inches of the length of the paper

to each measure. Then the space of an inch on the roll will represent a quarter note; a half inch a one-eighth note, and so on. Thus is mathematics applied to music. The width of the paper will be divided into columns, each representing one note on the piano; 65 is the usual number of notes for which mechanical players are designed. An inch laid out in the middle column will eventually produce the corresponding quarter note, etc. Thus the whole roll is marked out following the sheet music, as modified by the musical director.

The master roll is now ready to be perforated. This is done by a machine such as shown in Fig. 2. A number of blank rolls with the master roll on top are passed under a bar on which are suspended 65 little perforating dies. This bar descends by the pressure of the operator on a pedal. The only die which cuts, however, is that which has been engaged by a little ring, moved by hand along a supporting rod to a position above that die which will cut in the desired column. The operation is repeated until a perforation of the desired length is made. As several rolls have been cut at the one operation, there is an abundance of material for the final work of the music department. The master roll is placed in the mechanical piano player and played from, the musical director noting the effect produced. Perchance, in originally laying out the roll he has inserted a note which does not harmonize well, or, haply, omitted a note which would improve the effect. He revises the master roll accordingly, and missing notes are punched in and undesired punchings are eliminated by pasting little pieces of paper over them. A decided advantage possessed by this system in comparison with the old system, wherein the master rolls are as cumbrous and unwieldy as the archives of a nation using the sign language, is found in the fact that the former can be played from for determining their musical characteristics, while the latter cannot.

The capacity of one of the perforating machines, that is, the number of rolls which can be made at one time, is limited only by the number of pieces of paper which the cutting disc can perforate cleanly. Fig. 3 shows twelve rolls being perforated at once. The usual practice, however, is to increase this number considerably. The blank rolls having been put in place on the machine, the master

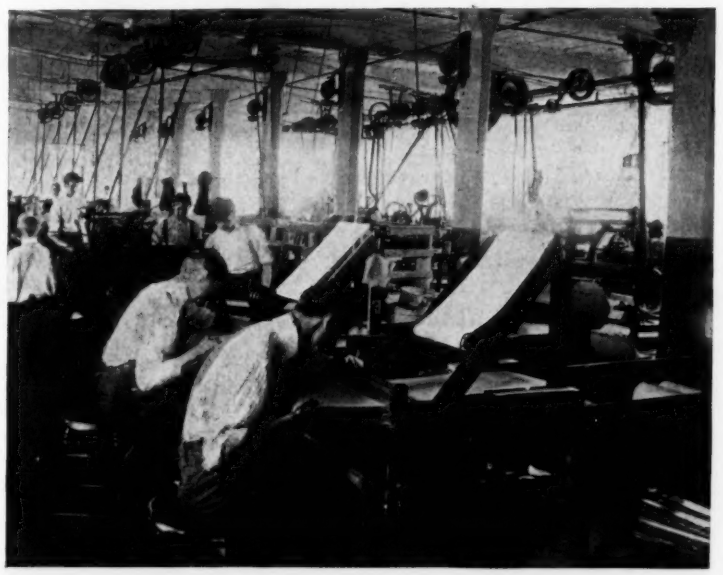


FIG. 2.—CUTTING THE MASTER ROLL.

roll is started through and passes between a copper roller and a set of 65 small metallic flexible prongs which press against the paper. Obviously, when a perforation is reached one of the prongs comes in contact with the copper roller. By this contact an electrical circuit is established and the current energizes an electrical magnet which puts into action a small die. This die has hitherto been vibrating idly up and down in a row with 64 others, without coming in contact with the rolls of paper which are passing under them. The die once thrown into action makes a continuous perforation as long as the current flows through the magnet. The current in this magnet, of course, ceases at the instant that the corresponding perforation in the master roll has completely passed under the little prong and the latter has once more been removed from contact with the roller. It is evident that the master roll being moved through the machine at the same rate as the rolls to be cut, every perforation in the master has been absolutely duplicated in the others. Expression marks having been put on the rolls by means of a stencil, after being carefully mounted on reels, the completed music rolls are ready for shipment.

In case the perforated music for a popular piece is already on the market, such a roll can be used as a master on the electrical perforating machines, thus obviating the trouble of laying one out with rule and compass, as above described. Here a possible obstacle suggests itself. The ordinary grades of paper contain more or less iron—present as an impurity in the alum used in paper manufacture. These particles of iron, minute as they are, nevertheless are conductors of electricity and, if not removed, would complete the electrical circuit in the cutting machine and produce the same effect

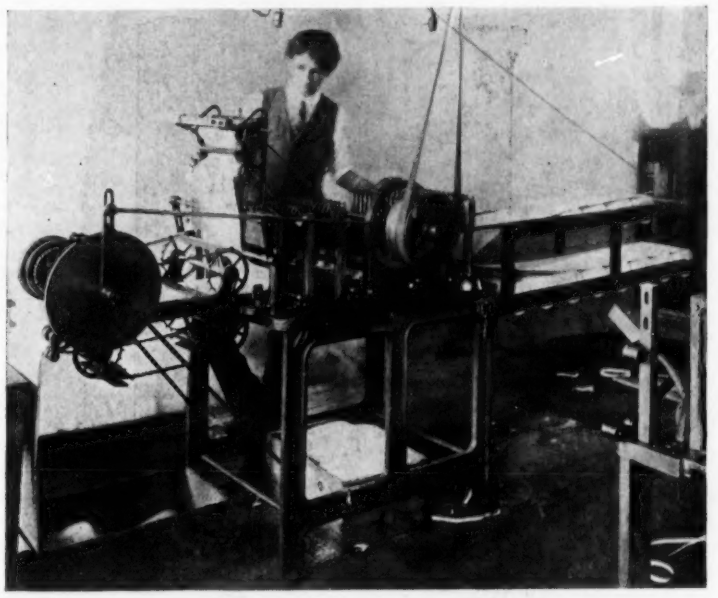


FIG. 3.—PERFORATING MACHINE.

as a perforation. Here again, electrical methods solve the difficulty. The roll purchased in the market is first corrected by cutting and pasting to satisfy the requirements of the musical director. It then goes to the iron-removing machine. This consists simply of two metallic rollers between which is maintained a difference of electrical potential of about 100 volts. The roll is passed between these and as each particle of iron is encountered the current leaps across from one roller to the other, burning out the iron as it passes. The flashing of a lamp placed in the circuit makes this known to the attendant and he "doctors" the roll by pasting a piece of paper over the spot. The roll is now ready to be used as a master in the perforating machines.

It is by methods such as above described that perfection has been obtained in perforated music—absolute precision in the processes of manufacture, yet an elimination of those defects which gave "mechanical" qualities to the resulting music.

A Canadian Municipal Telephone Plant.

Although many of the smaller cities and towns throughout the Dominion of Canada have established, under municipal control, many of the public utilities, comparatively few have as yet ventured into the telephone field. The first instance on record where the municipality entered into independent telephony and set up competition with an existing plant, is the public service system established and operated by the town of Neepawa, Manitoba.

After an exhaustive test of the various systems submitted in competition, the municipality adopted the self-restoring drop, magneto-call switchboard, arranged for future central energy system, manufactured by the International Telephone Manufacturing Company, Chicago. This system enables the town to come within its present available funds and still provide for ultimately changing to complete central energy without discarding any of the new apparatus installed. The International Company was also given the orders for a large quantity of lead-covered, paper-insulated cable, and all construction material, and were also awarded the contract for rebuilding the outside construction.

The central office apparatus selected embodies many new features

The new Stanley wattmeter is made with two terminals, one at the bottom, the other at the top, for connection through the meter of the two wires of a two-wire circuit, or of the two outside wires of a three-wire circuit; the shunt connection being provided within the meter.

Another characteristic and valuable feature of the new Stanley rotated-bearing wattmeter is the complete magnetic shield separating the shunt and series elements from the brake magnet system. This magnetic shield is the diaphragm, or iron plate, comprising the entire top of the front of the case. Between this cast-iron front plate and the back plate of the case are contained the shunt and series coils which are thus completely enclosed in an iron box. The brake magnet and brake adjusting screws, the disc shaft and the train system are mounted on the side of the shield plate opposite from the coils.

Rigorous tests of all kinds have been made upon the new Stanley meter for many months, and it has been subjected to the closest scrutiny and criticism by the manufacturers and other experts before having been offered to the public. It will be sold with or without a three-years' guarantee of accuracy, as the customer may dictate.

An Allis-Chalmers Group.

A gathering of the Allis-Chalmers forces was held recently at the Reliance Works of the company at Milwaukee. The convention included not only members of the sales force, but some of the officers and heads of departments. A group portrait was taken at the time, with a copy of which we have been furnished, and which we reproduce herewith, accompanied by a key. A great many of the persons in the group are known to the field of electricity. The names corresponding to the numbers in the key are as follows:

1, James Tribe; 2, G. C. Forgeot; 3, A. Niedermeyer; 4, W. J. Sando, manager pumping engine department; 5, W. H. Whiteside, general manager of sales; 6, W. J. Chalmers, vice-president and treasurer; 7, B. H. Warren, president; 8, A. M. Mattice, chief engineer; 9, Arthur Warren, manager of publicity; 10, B. A. Behrend, chief engineer of electrical department; 11, C. C. Tyler, general superintendent; 12, W. M. S. Miller; 13, Ervin Dryer; 14, F. F. Coleman; 15, James Ashworth; 16, H. A. Allen; 17, W. W. Nichols, vice-president and secretary; 18, J. F. Harrison; 19, Almon Emrie, superintendent Milwaukee works; 20, W. G. Starkweather; 21, J. R. Jeffrey; 22, C. J. Printz; 23, H. S. Mitchell; 24, I. L. Skeith; 25, G. C. Henry; 26, Robert Mulford; 27, J. C. Buckbee; 28, H. Woodland, assistant treasurer; 29, Clemens Herschel, manager hydraulic turbine department; 30, C. A. Burns; 31, H. L. Wells; 32, Franklin Wharton; 33, H. V. Croll; 34, G. L. Tifft; 35, J. D. Millar; 36, W. C. Trout; 37, M. C. Miller; 38, W. A. Wood; 39, H. Schifflin; 40, J. A. Milne, comptroller; 41, H. S. Pell; 42, G. S. DeWein; 43, H. J. Holden; 44, M. J. Furlong; 45, George T. Thomas; 46, W. E. Dodds, superintendent of construction; 47, Richard Hoppin; 48, H. C. Helvey; 49, Albert Hoppin; 50, A. J. Gates, superintendent Chicago Works No. 1; 51, George L. Fisher; 52, W. N. Tanner; 53, Richard Barnard; 54, F. W. Greenleaf; 55, H. S. Mallalieu; 56, H. I. Keen; 57, J. O. Watkins; 58, R. J. Glendenning; 59, G. F. Collins; 60, R. D. Tomlinson; 61, C. A. Derby; 62, G. A. Berg; 63, J. C. M. Lucas; 64, W. O. Everett; 65, H. A. Hammil; 66, D. T. Jones.

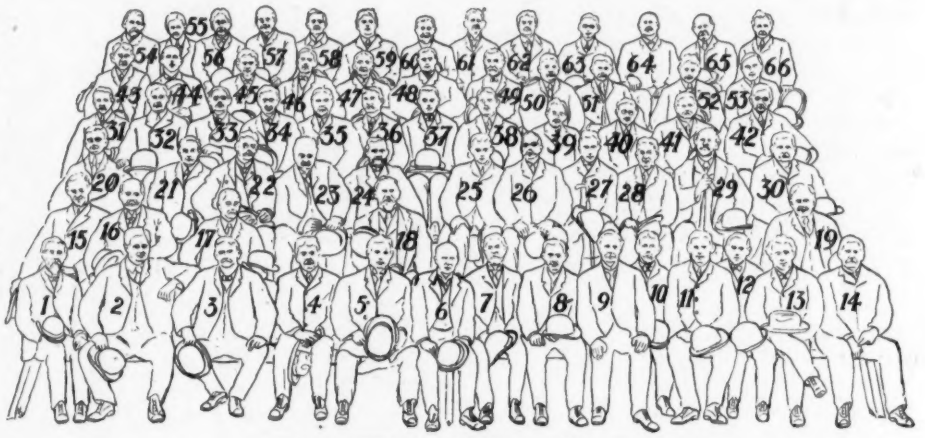


FIG. 2.—KEY TO GROUP PORTRAIT BELOW.

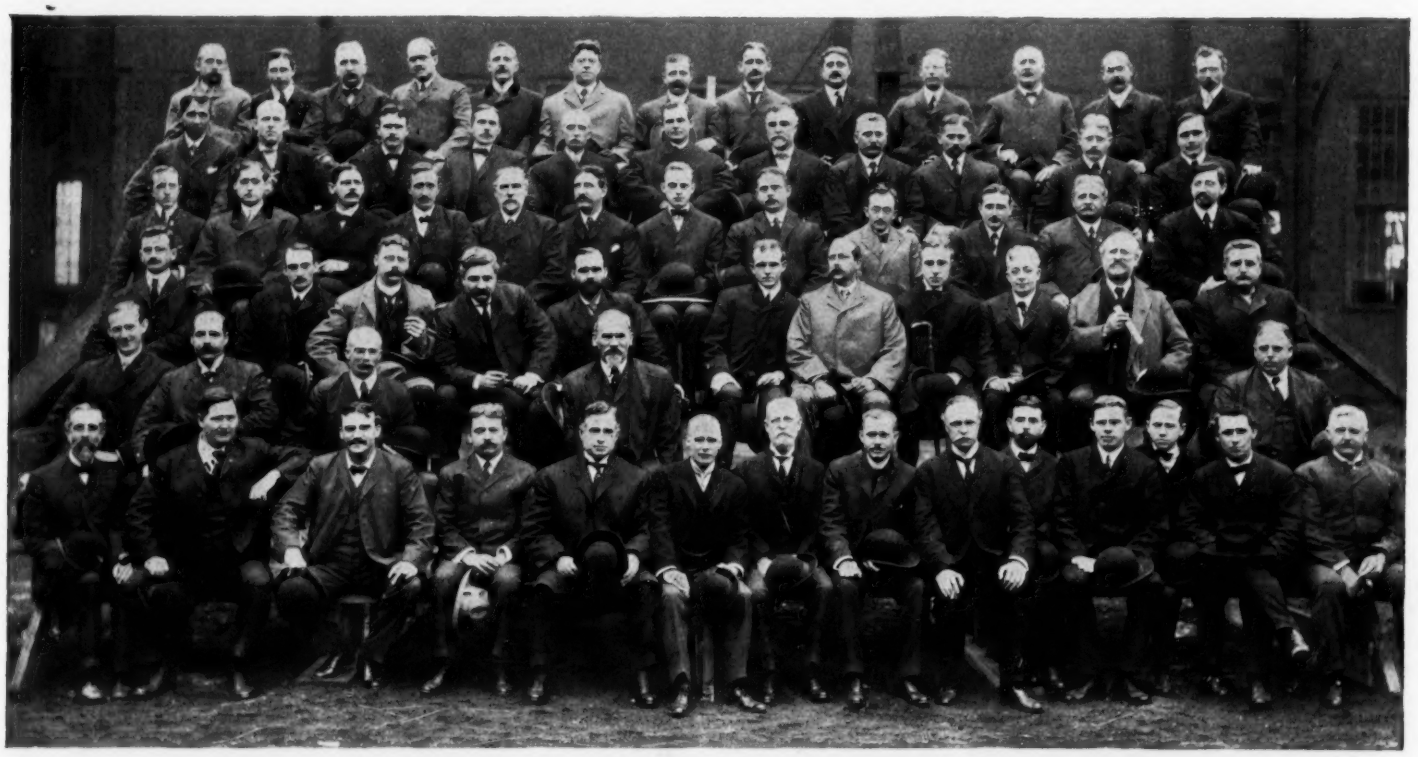


FIG. 1.—SOME OF THE OFFICERS, HEADS OF DEPARTMENTS AND SALES FORCE, ALLIS-CHALMERS COMPANY.

Electrical Equipment for Chili and Peru.

Mr. J. K. Robinson, of Iquique, Chili, has secured a number of interesting contracts for electrical and other equipment to be installed in freight handling, sugar, nitrate and other plants on the west coast of South America. The extensive docks at Caleta Buena,

Chili, are to be installed with electrical apparatus. At present the cranes, etc., are operated by steam power. The new equipment will include 200 hp of Babcock & Wilcox water-tube boilers, Westinghouse engines and generators and a number of 10-hp Westinghouse motors for working the cranes. The cranes will be converted into electric machines in Chili. This machinery will be utilized for carrying coal and other cargo from the ships to the railroad cars. The British Sugar Company's factory at Cerro Azul, Peru, is to have a small 125-volt, 410-r.p.m. Westinghouse lighting plant. Lighting outfits of similar build will also be installed in the Oficiana Carmen Bajo and Oficiana Alto Junin, two of the larger nitrate plants in Chili. The Oficiana Victoria at Junin, one of the largest nitrate plants on the west coast, is to be equipped with some more American machinery. Practically all the nitrate concerns in that part of the world are under British financial control. Another electric locomotive has been ordered for the Victoria plant. The electrical equipment will be of Westinghouse build, and the other parts will be turned out at the Baldwin Locomotive Works, Philadelphia. Ten electrically-driven triplex and centrifugal pumping equipments have been contracted for with the Goulds Manufacturing Company, of Seneca Falls, N. Y. These outfits are to be operated by Westinghouse motors, varying in capacity from 7½ hp to 15 hp each. The Oficiana Agua Santa, Chili, is to be shipped two 100-kw belted generators of Westinghouse type and a score of Westinghouse motors varying from 50 hp to 5 hp. There will also be six Goulds pumps of various types to be driven by Westinghouse motors.

Mr. Robinson's list also includes a Westinghouse lighting equipment complete with arc lamps for the machine shops of the Autofagasta Railway Company, Chili, and several Westinghouse motors for driving a big ice making plant at the port of Junin, Chili.

Troy Voltmeters and Ammeters.

The Troy Electrical Company, of Troy, N. Y., is placing on the market a line of round pattern, iron-clad voltmeters and ammeters designed to meet the need for switchboard ammeters and voltmeters, first-class in every respect, and not of extremely delicate construction, which has long been felt. The working elements are extremely simple, consisting of a permanent magnet and two stationary coils, together with a pointer and its pivot, provided with a small steel vane. The lightest moving element is possible in this instrument, the steel vane being but .010 of an inch in thickness and ¾ in. in diameter, and great torque is developed. This means both accuracy and long wear. The material in the steel vane is especially selected stock with reference to its magnetic permeability and its freedom from magnetic lag, no scale or oxide being allowed to remain on the surface. This gives an instrument perfectly reliable in its indications under any conditions, and for either ascending or descending measurements. The indications of the instrument are caused to be dead beat by a small aluminum damper, the moving element being extremely light.

The electrical losses are small, a 125-volt instrument having a resistance of over 3,000 ohms. The resistance is formed of an alloy having a very small heat coefficient, thus rendering the indications accurate irrespective of changes in temperature. Insulation is of the best and all instruments are subjected to a rigid breakdown test before leaving the factory.

The permanency of the magnet is the vital point of all permanent magnet instruments. This depends upon the length of the magnet relative to the air-gap, the density of magnetic flux, the process of magnetizing, the process of ageing and the ingredients in the steel itself. Special tungsten steel is used. Tungsten introduced into the steel as an alloy aids in interposing a barrier against the rearrangement of the molecules of steel and consequent loss of magnetism. The process of magnetizing is to subject the hardened steel blanks to a magnetic flux of maximum density, the idea being to affect the molecules most difficult of movement, the theory being that actual movement takes place. Then by reversing the direction of the magnetic flux and lessening it in density, the magnet is demagnetized until but 20 per cent. of the original charge remains. This 20 per cent. is then due to the molecules most difficult to move, and which are, therefore, most permanent. The final ageing is done by subjecting the magnets to a long series of extreme temperature changes. The length of steel entering into these magnets is over 14 in. and the air-gap being bridged by the steel vane of the moving element is very short.

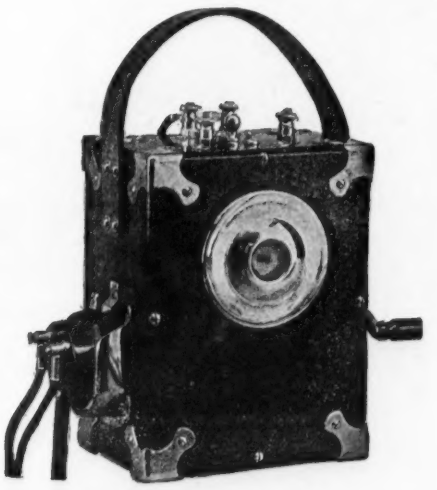
All the conditions necessary for permanent calibration are met. Hundreds of instruments made under this plan and in constant and severe use have shown no change whatever. The instrument is extremely sensitive, the scale open throughout its length. By the peculiar arrangement, relatively, of the poles of the permanent magnet and of the stationary coils, the scale is caused to be more open in those portions most used, which is an important point in a switchboard instrument that has to be read from a distance.

The iron base and carefully fitted iron cover form a first-class magnetic shield, and errors due to proximity of bus-bars or other conductors are thereby obliterated.

FIGS. 1 AND 2.—VOLTMETER AND AMMETER.

Weatherproof and Portable Telephones.

The Connecticut Telephone & Electric Company, of Meriden, Conn., which has added street railway telephone equipment material to its lines, has gotten out a new type of weather-proof iron box telephone. The box is attractive and is designed for exchange connection as well as for street railway purposes; it is also designed for mine and police systems and can be arranged for magneto or common battery systems as required. The left-hand section contains the hand microphone and lightning arrester. The right-hand section contains the batteries, generator, ringer and induction coil.



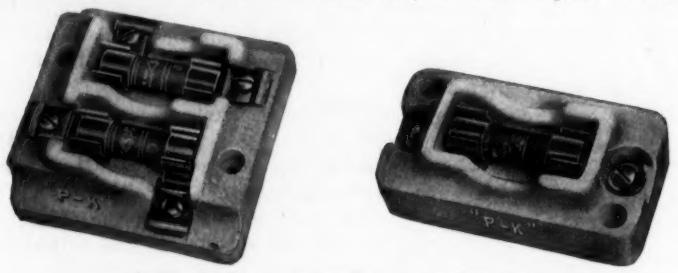
PORTABLE TELEPHONE.

In the base is the gong box, in which are mounted 3-in. duplex bells, which are audible for a considerable distance. The instrument is also made up without bells and the hand microphone is also furnished without the switch in the handle, the necessary switch being thrown when the door is opened. In two styles the switch is open when the door is closed, so that there can be no possible chance of a burn-out by lightning or high-tension currents. This type is recommended especially for street railway use on account of the great number that can be placed on one line.

This company is also furnishing complete portable telephone sets for street railway use. The instrument, which is a complete telephone in itself, is fitted with solid back transmitter, watch case receiver, and two cells of pocket dry battery. It will work any distance and is suitable for light electrical wiring, telegraph, telephone lines, cables and inside wiring. The instrument is also largely used in the army. Where the instrument is used for street railway purposes weather-proof jack boxes are furnished which are mounted on poles at various points along the line.

Cartridge Fuse Cut-Outs.

A new line of cartridge fuse cut-outs made according to the new National Code standard, with capacity from 3 to 30 amp., have been brought out by H. T. Paiste Co., of Philadelphia. These,



FIGS. 1 AND 2.—CARTRIDGE FUSE CUT-OUTS.

of course, fit the "New Code" fuses, and are made in eight styles, which correspond with the similar styles of the familiar plug cut-out type. The company has used the same catalog numbers, but has

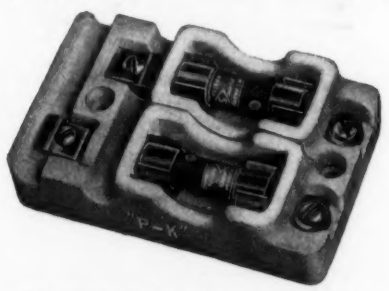


FIG. 3.—CARTRIDGE FUSE CUT-OUTS.

prefixed the number "7," so that these old numbers will instantly recall to mind the proper cut-outs to be used. These cut-outs are the spring clip type, for the ferrule type of cartridge fuses, and

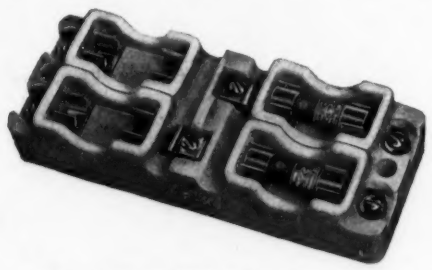


FIG. 4.—CARTRIDGE FUSE CUT-OUTS.

each fuse is safely held in its own compartment. It is impossible to short-circuit these cut-outs accidentally, and they will be found most compact and substantially made. A bulletin giving prices and discounts is issued.

Fault-Locating Instruments.

For the location of faults in electric circuits, the potentiometer principle, as embodied in Murray's and Varley's loop tests has long been a favorite. The apparatus used to make the tests, however, has for the most part been of the crudest nature, consisting generally of a few feet of flower wire stretched on a rough wooden frame contact being made by a loose end of a lead from the galvanometer.

The disadvantages of this rough arrangement are: (*a*) Difficulty in measuring the exact point at which balance is obtained; (*b*) variation in the sectional area of the wire, due to inequalities in the drawing process; (*c*) difficulty in making an even contact with the wire, and finally (*d*) the bulky nature of the wooden frame, hence the difficulty of transport without damaging the working wire.

The instrument here described has been designed with a view to overcoming these disadvantages. The first and simplest form is that shown in the illustration. It has a resistance of about 15 ohms and is intended for a testing e.m.f. across the loop of about 12 volts.

In this instrument there is a working wire of platinoid of one meter length, and of about 1.5 ohm resistance. This wire is stretched on a meter rule upon which a suitable contact maker slides.

In conjunction with this wire are used 18 non-inductive resistance coils, each of exactly the same resistance as the working wire, connected up between the contacts of the selector switches and in series

FAULT LOCATER.

with the working wire in such a manner that whatever the position of the selector switches there are always 9 coils and the working wire in series between the terminals of the instrument, and the working wire may be made to take any position in the sequence of the coils, thus giving the equivalent of a working wire 10 meters in length.

It will, therefore, be seen that from the position of the selector switches and of the contact on the working wire, the point at which balance is obtained can be immediately read off; thus if the switch is at 7 and the contact at 569 on the working wire, the position of the fault is at 0.7569 of the length of the loop, measuring from terminal *A*.

For use in locating the position of very high resistance faults, a modification of the above instrument allows a terminal pressure of 200 volts to be employed, thus permiting the use of a direct-current generator to supply the test current, and of a Weston millivoltmeter for balancing. This high-voltage instrument occupies a space of about 16 in. by 16 in. by 16 in. high. The description here given has been supplied to us by Mr. Trubie Moore, assistant engineer of the Yorkshire Electric Power Company, Leeds, England.

Coal Handling Machinery as Applied to the Power House.

An interesting and modern equipment of coal-handling machinery has recently been installed in the new power house of the Philadelphia Electric Company, located at Christian Street Wharf, Schuylkill River, Philadelphia, by the Link-Belt Engineering Company, of Philadelphia.

The boiler house, which is double-decked, stands on low ground adjacent to the Pennsylvania Railroad tracks, and has sufficient floor space to accommodate 16 650-hp boilers on each floor. At the present time twelve boilers have been installed on the first floor, nine of which are in use, and consume an average of 100 tons of bituminous coal per day of 24 hours.

Coal cars are shifted into the yard on a double-track trestle, elevated 27 ft. above the basement of the boiler house, at which point they drop their contents into a steel hopper spanning both tracks. This hopper is fitted with a "link-belt" reciprocating feeder, which controls the delivery of lump anthracite or bituminous with masses 30 in. and larger in diameter, as readily as it does the delivery of buckwheat coal. This is rendered possible by the fact that the rate of delivery is entirely independent of the size of the discharge opening in the hopper, and that the opening can, therefore, be made large enough to suit the lumps to be handled.

By means of the reciprocating feeder, coal is automatically transferred in uniform quantities and regularly to a "link-belt" inserted steel-tooth crusher, and besides dispensing with the labor of one man at the hopper to assist and regulate the flow of coal, it prevents overloading the machine and consequent dangers.

The crusher is mounted on a cast-iron frame and enclosed by a steel housing. It is made with two charcoal iron, chilled rolls, one

of which is mounted in spring bearings, to allow it to yield to a piece of iron or other hard article that may enter the machine. The crusher and feeder are driven by a 15-hp motor.

From the crusher, coal is spouted to the lower horizontal run of a "link-belt" gravity discharge elevator and conveyor, consisting of two strands of forged chain with steel buckets attached at intervals. The vertical run of the machine is supported on foundations by a steel tower sheathed with corrugated iron (Fig. 1). After receiving coal from the crusher, the elevator and conveyor carries it 30 ft.

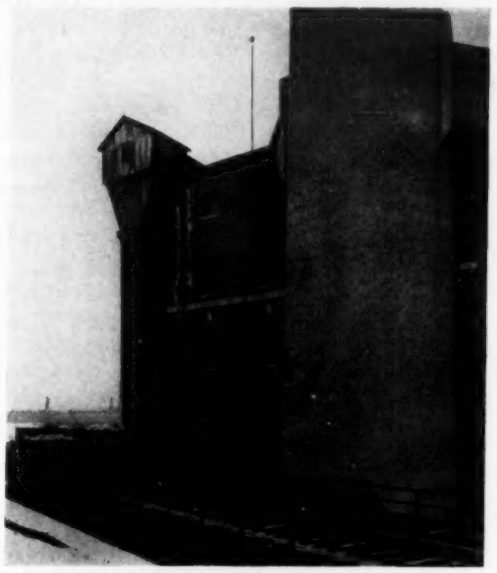


FIG. 1.—STEEL TOWER CONTAINING LINK-BELT, GRAVITY DISCHARGE ELEVATOR AND CONVEYOR.

horizontally, then 106 ft. vertically, and then 60 ft. horizontally directly under the roof of the boiler house. A 30-hp motor is used for operating this machine.

On the upper horizontal run, coal is discharged into either one of two roller flight conveyors, at present having only 155 ft. centers each, but designed to permit an increase in length when the boiler house is extended. Each of these machines is driven by a 15-hp motor, and consists of suspended roller flights attached at intervals to closed joint link-belting (Fig. 2). On the conveying run the rollers serve to suspend the flights, so that they will not come in contact with the trough, thus preventing noise and reducing wear to the minimum. The coal is distributed in the 2,000-ton pocket

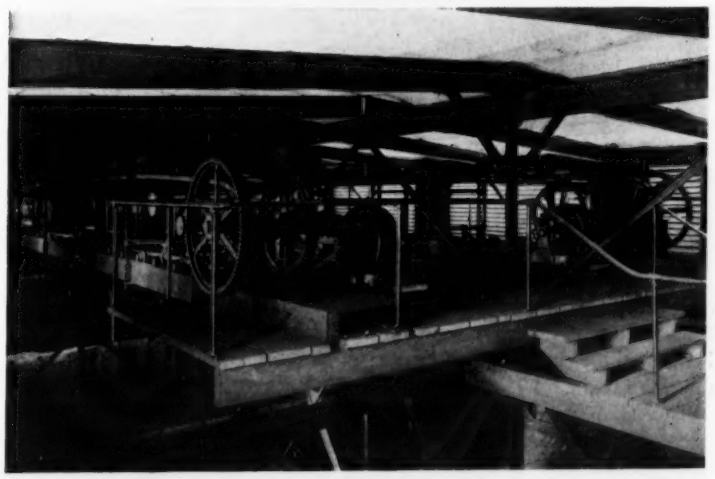


FIG. 2.—DRIVING ENDS OF TWO LINK-BELT ROLLER FLIGHT CONVEYORS.

through "link-belt" rack and pinion discharge gates with which the conveyor troughs are fitted.

The coal bunker is equipped with eight chutes, which are arranged to spout the coal in front of the boilers on first and second floors. While this machinery is guaranteed to handle 100 tons per hour, the crusher easily reduces run-of-mine bituminous coal to about 3-in. cubes, or smaller, at the rate of 130 tons per hour, the elevator and conveyor having capacity to handle the crushed coal at the same rate.

Before the installation of the elevating and conveying machinery, coal was unloaded by a crane equipped with clam shell bucket, in a pile about 200 yards from the boiler house, and then reloaded by the same crane into trolley cars and carried to the boiler house. This operation required the services of six men every day, whereas the present equipment necessitates the employment of but one man one hour each day, to keep the bunker well supplied with coal, and has the further advantage of always having in reserve enough coal to meet all demands of the boilers for twenty days.

Rheostats on Dynamo Test Board.

The engravings herewith, Figs. 1 and 2, show an arrangement of three independent sets of rheostats used by the Ridgway Dynamo & Engine Company upon their dynamo test board. Each set consists of three 15-in., 60-step Ward Leonard enameled rheostats. Each of these three rheostats is connected in series. Any one of the rheostats can be operated independently by one hand wheel common

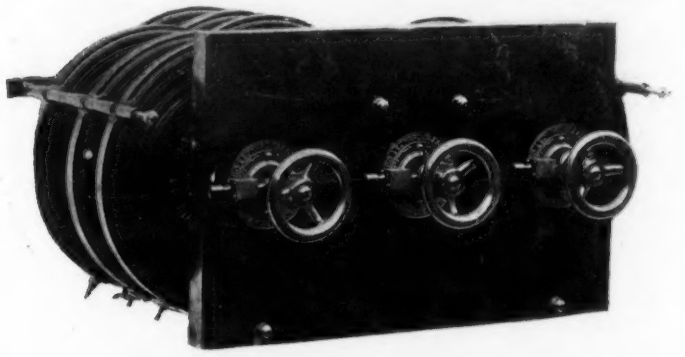


FIG. 1.—FRONT VIEW OF RHEOSTAT.

to all three. The arrangement is extremely simple. Fig. 1 shows an end view. Fig. 2 shows a rear view of this arrangement.

In the shaft, directly behind the hand wheel, are three grooves running around the shaft. Fitting into one of these grooves is a small plunger or guide, controlled by the small wooden knob shown. By placing this guide in any of the respective grooves, any desired

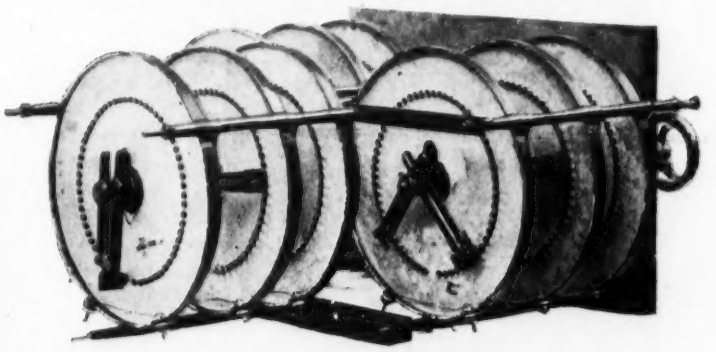


FIG. 2.—REAR VIEW OF RHEOSTAT.

one of the three plates can be operated. This arrangement replaces the old arrangement with concentric shafts or gear wheels, etc.

As the plates are standard rheostat plates, and all parts are standard, with the exception of a few small minor parts, such a bank of rheostats can be quickly constructed, additional plates readily added, etc. The apparatus was built by the Ward Leonard Electric Company, of Bronxville, N. Y.

Small Dynamo Electric Machinery.

The R. M. Cornwell Co., of Spracuse, N. Y., is putting on the market a line of direct-current dynamos and motors. It will consist of a complete set of experimental machines from the smallest made up to a 1-kw for commercial purposes. It expects when completed to have the largest variety of small machines on the market, especially in the small sizes for experimental purposes.

The accompanying illustration shows the "Wonder" dynamo, which, it is said, is the smallest generator of its kind on the market. It has an output of about 12 watts and is wound for a number of

different voltages. In bringing out this machine it was the aim of the Cornwell Company to put on the market a small generator following in every detail the construction of large commercial machines. Among its special features are its laminated armature, adjustable brushes, large and strong commutator, heavy interchangeable bearings. In its construction the idea has been to make the machine complete and efficient, to be used where a small amount of current

SMALL DYNAMO.

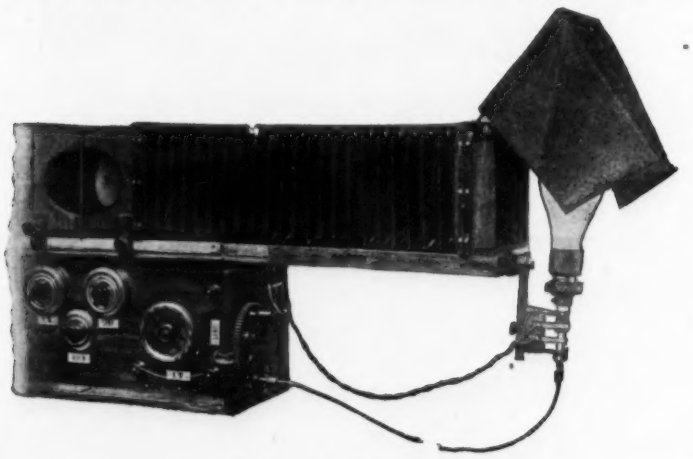
or power is required, and to be especially desirable in connection with any experimental work. As a motor, it will operate running light on about 2 watts, and with sufficient battery will do a wonderful amount of work. It is also wound to run in series on a 110-volt lighting circuit. All parts are interchangeable and made of the very best material. The company will put forward its different sized machines as fast as it has them ready for the market.

Queen Portable Photometer.

The instrument shown in the accompanying illustration is the Queen portable photometer, into which a number of improvements have recently been introduced, which simplify the method of the operation, and give more accurate results.

This photometer, as originally put out, has been largely used for measuring the candle-power and efficiency of incandescent lamps. As so many incandescent lamps are now rated in mean horizontal candle-power, Queen & Co. have recently added an attachment by means of which the lamp being tested can be rotated. The device is simple and easily attached; and, as shown in the illustration, consists of a rotating socket connected by means of a flexible shaft to a pair of gear wheels, clamped to the side of the photometer case. The rotating motion given to the large wheel by the hand is multiplied several times, and the lamp easily rotated at any desired speed. The device can be removed, as there is sufficient room in the photometer case to allow it to be packed for transportation.

The use of the bellows on the photometer, shielding the scale from extraneous light other than given by the lamp under test, has



PORTABLE PHOTOMETER.

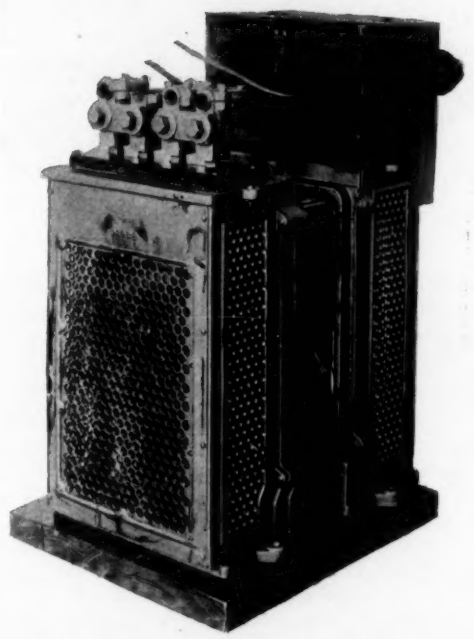
proved to be of much value, allowing the photometer to be used in a room with ordinary illumination, and securing extremely satisfactory results.

The necessity of using one voltmeter and the provision of two rheostats, one for adjusting the current on the test lamp and the other for adjusting the current through the standard lamp, have been found to work satisfactorily, proving the instrument to be thoroughly adapted to the commercial measurement of incandescent lamps. The scale is divided from 4 cp to 50 cp, which allows a range of measurement as wide as is necessary in practical work.

Transformer Outfits for Thawing Pipes.

The manifest superiority of electricity as a thermal agent in thawing frozen pipes, and the field for this service that awaits development, has attracted a considerable amount of attention on the part of central station managers, many of whom have improvised oufits for this purpose. There has arisen a very general demand for thawing outfits that shall have a range in capacity to cover all ordinary requirements; shall be portable, easy to connect and moderate in price, and to meet this demand the Westinghouse Electrical & Manufacturing Company, has designed the two transformers described below.

The larger of the two outfits, shown in the illustration, weighs, complete with the transformer, switchboard and base, 750 lbs. It occupies a floor space 2 ft. 4 in. by 1 ft. 10 in., and is 1 ft. 7 in. in height. A link in the top of the transformer case affords a means of lifting the outfit, and if desired truck wheels may be attached to



TRANSFORMER FOR THAWING PIPES.

the wooden base. It will be seen that it is of small size, and it is claimed to be lighter in weight than any other outfit for the same purpose, giving it a superior portability. .

The transformer may be operated satisfactorily on circuits varying from 1,800 to 2,500 volts. The low tension is arranged to deliver approximately 500 amperes for several hours at an e.m.f. of from 15 to 50 volts. By a simple change in connections, the windings may be arranged to deliver about 1,000 amperes at voltages from 8 to 16, for thawing large mains whose resistance is generally low. It is suitable for thawing anything from a one-half inch pipe to a one-foot main.

The transformer is generously designed, and will deliver large overloads for short periods of time. The windings are air cooled. The insulation is not injured by rain, snow or ordinary abrasion. There are no moving parts to get out of order, and the entire outfit is contained in a single unit.

A light but substantial switchboard is mounted upon the high tension end of the transformer. The switches are of the enclosed plug type, such as are used upon high-tension arc light circuits, and permit a variation of the low-tension voltage and consequently the current supplied to the pipes. The switches are so arranged that it is impossible to make a wrong connection.

A smaller transformer outfit designed for thawing service pipes about dwelling house is designated as No. 46811. It is light, of such proportions as to make it easy to handle, and is mounted in a

wooden box provided with a handle and shoulder strap. It has a capacity of 200 amperes at potentials up to 25 volts for one hour. It is arranged for operation off a nominal 2,000-volt circuit, but can be supplied for any other primary e.m.f. to as low as 200 volts. The voltage regulation and current control are obtained through plug switches in the high-tension circuit.

When desired, these outfits are furnished with a current measuring device so that the operator may know the amount of current that is being used.

Wireless Telegraph Performances.

The following data is furnished us by the American De Forest Wireless Telegraph Company as to recent performances with their system:

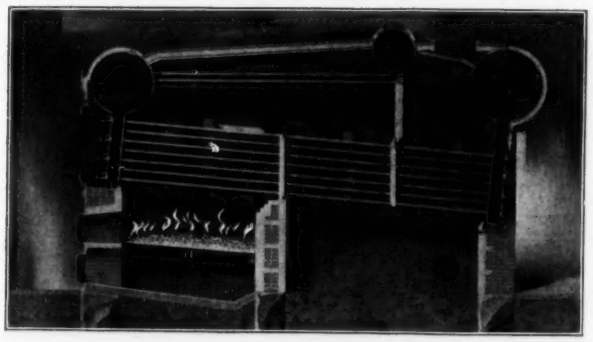
On January 10 the Mallory steamship *Denver,* coming north, reported herself 10 miles south of Diamond Shoals Lightship, off Cape Hatteras. This message was clearly read by the De Forest operator at Cleveland, Ohio, and was forwarded to the New York office for corroboration.

The *Bermudian* of the Quebec Steamship Company, left New York January 18 at 10 a.m. At 10 p.m. the Cleveland station read a message from the *Bermudian* stating that she was then 200 miles from New York.

On January 21 the Red "D" Liner *Philadelphia* left New York at 12 o'clock noon and at 10 p.m. reported herself 130 miles out. This message was read by the De Forest operator at Port Huron, Mich. All of these boats are equipped with 1-kw apparatus and with very short masts. The Cleveland station is now regularly reading messages from the Chicago station.

Atlas Water-Tube Boiler.

The new design of water tube boiler placed on the market by the Atlas Engine Works early in 1904 has won a notable factor in capturing a large order from Japan, supposed to be for the use of the Japanese Government in reconstructing the docks at Port Arthur. This type of boiler is interesting in the fact that it differs very radically in some particulars from any of the older constructions. It is composed of a nest of tubes, set on the ordinary incline between water legs, and three drums running across the tubes instead of



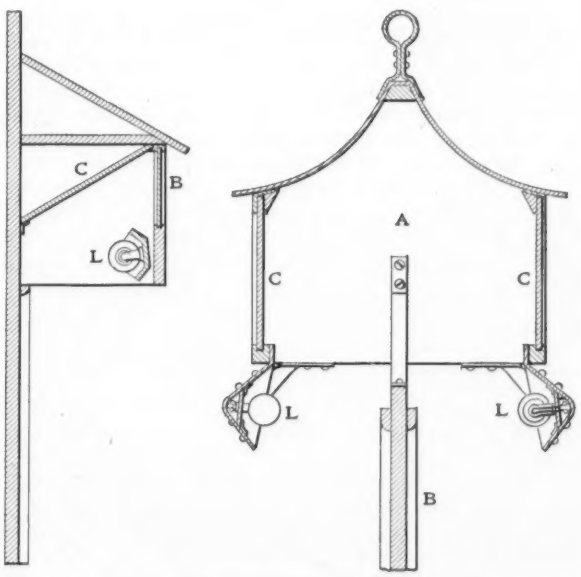
WATER-TUBE BOILER.

lengthwise at the top. Two of these drums, the front and rear, are each a part of the same plate, composing the water leg with which it is connected.. This method of construction enables the builders to avoid placing seams next to the bottom, where they are covered by the masonry, while the seams of the drums are located on the top, away from the fire. This method also gives a full length opening at the throat, where the water passes between the leg and drum. The throat is strengthened with a patent twisted brace, which leaves over 80 per cent. of the area open. The rear drum contains a mud pan through which the feed water flows and where practically all the impurities of the water are precipitated. A connection through the drum head admits of the pan being blown out. This mud pan, or purifier, is built in sections, and can be removed through the manhole of the drum and renewed at small expense when it becomes pitted. The mud pen occupies a small space, and there is considerable generating surface in the rear drum.. The fresh water flows down through the rear leg and up through the tubes and front leg to the front drums, where there is a large releasing surface. The two drums are connected by straight equalizing tubes, arranged in three tiers along the ordinary water line. Each of these drums is connected with a middle drum by tubes, and the steam, as it is released, travels through these tubes to the middle drum, from which it is taken for use. Experience has shown that by thus carrying the steam to a third drum through tubes exposed to the furnace gases, not only is perfectly dry steam obtained, but the steam is superheated from 10 to 22 degs., according to the state of the fire. Since all the tubes carrying water are straight and readily accessible, the boiler is easily cleaned.

Electric Display Signs.

The increasing use of electricity in the illumination of display signs is in evidence on all sides. To a greater and greater extent is it becoming true that no insignificant portion of the income of many electric lighting companies is derived from this source. A well-illuminated display sign is an attractive advertisement both for the owner of the sign and for the lighting company. Bearing on this matter is an attractive and economical arrangement of the display sign and the lamps for illumination, which is embodied in a construction designed and recently patented by Mr. Robert W. Clark, of St. Paul, Minn.

As shown in Figs. 1 and 2, reproduced from the patents, projecting forwardly from the back wall, in Fig. 1, is a casing consisting of a top wall and a front wall. The front wall is provided with a suitable transparent sign, *B*. The plate, *C*, is a reflector and serves to cause the rays from the lamp, *L*, to pass outward through the transparent sign. Behind the lamp, *L*, is placed a V-shaped reflector mounted at either end upon supports which allow it to be placed at



FIGS. 1 AND 2.—ELECTRIC DISPLAY SIGNS.

any angle, so that any desired portion of the light may be thrown upon the display sign or through the transparent sign. This arrangement is especially adapted for use upon the side of a building.

The duplicate construction, shown in Fig. 2, is designed particularly for suspension above a street where the sign is to be viewed from both directions. Transparent signs, *C*, are placed in opposite sides of the hood. The downwardly extending display sign, *B*, has display surfaces on both of its sides. Each lamp throws rays of light against the adjacent display surface and through the hood above the display sign, to the opposite transparent sign.

The lower signs being of porcelain and the upper ones being of glass having white frosted transparent letters on a colored background, this type of display sign is attractive both by day and by night. The patents of Mr. Clark are controlled by the Western Display Company, Milwaukee, Wis., which manufactures signs on the principles they cover.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The storm of the past week and the political complications abroad tended to check activity in commercial and financial markets. Distributive trade, railway traffic and some forms of production were retarded by the storm, as a result of which irregularity in the reports from different sections is noted. Most industrial lines continue busy. The volume of new buying in iron is light, but specifications are coming out freely and current production is above the maximum. Hardware seems to be in active demand the country over. Iron and steel prices are steady at recent revisions, except in the case of old material, which is weaker. Copper seems easier after the late spurt. The closing quotations are 15⅜c for Lake; 15¼c for electrolytic, and 14⅞ and 15c for casting stock. Lumber is in a very strong position in the Northwest, where the cut has been the lightest in over thirty years; Southern lumber shows general improvement, and even in the Pacific Northwest there are signs of reaction from the late intense depression. Anthracite coal is strong and active, with stocks small, and in bituminous it is a question of deliveries rather than of demand that worries the trade. Machinery dealers report abundant inquiries and a favorable outlook. Railway earnings reflect the rather smaller movement of grain and relief in congestion in traffic previously reported in the smallest gains indicated for some time past. Bank clearings, too, have ebbed from the large totals reported some time ago, partly because of slack speculation, but large gains are still noted over this time a year ago. In distributive trade the backwardness of the demand for cotton goods is still a feature, but signs of improvement are not lacking. Country merchants at the South have large stocks that move slowly because of the decline in cotton, and collections are slow. *Bradstreet's* reports 228 business failures during the week ending January 26, against 304 the week previous, and 242 the corresponding week last year.

TELEPHONY IN KANSAS.—At a directors' meeting of the Kansas Telephone & Electrical Company, of Parsons, Kan., January 26, several important changes were made. The name of the company was altered to the Parsons Home Telephone Company, and an increase of $20,000 in the capital stock of the company was authorized. The company has in operation a new 600-line switchboard, recently installed by the International Telephone Manufacturing Company, of Chicago, and has almost finished the complete rebuilding of its cable and wire plant throughout the city. Both the switchboard and the cable plant are built with a view of an ultimate capacity of 1,000 subscribers. The work of rebuilding will be pushed with vigor and upon its completion the company will string 27 miles of copper to Cherryvale, making connection with the long-distance lines of the Kansas City Home Telephone Company and will build a copper circuit east to Pittsburg, Kan., and connect with the Kinloch lines at that place. The company's iron lines to Oswego, Cherryvale, McCune and Pittsburg, will be rebuilt and used for local toll service.

INTERNATIONAL STEAM PUMP ADVANCES PRICES.—The increasing activity in the machinery and allied lines of productive industry is indicated by a report that the International Steam Pump Company has advanced all prices 10 per cent. The company operates plants at Harrison, N. J.; Boston and Holyoke, Mass.; Buffalo, N. Y., and Cincinnati, Ohio, and controls the firms of Henry R. Worthington, the George F. Blake Manufacturing Company, the Knowles Steam Pump Works, the Holly Manufacturing Company, the Laidlaw-Dunn-Gordon Co., and the Clayton Air Compressor Works, producing a large percentage of all the steam pumps, water works pumping engines, air compressors, condensers and other power plant and hydraulic machinery used in this country. The company also conducts a big export trade. Although the Henry R. Worthington branch recently more than quadrupled its manufacturing plant, the latter is said already to be taxed to its full capacity. It also has a very large volume of work in sight.

AMERICAN MACHINERY AT LIÈGE EXPOSITION.—The great International Exposition scheduled to open April 30 at Liège, Belgium, will have a very extensive display of Yankee electrical equipment, machine tools, etc. In labor-saving devices, the American exhibit, it is expected, will be even more complete than that which was shown at the St. Louis World's Fair. A large portion of the machinery will be in operation. About one-half of the space allotted to the United States has been secured by Mr. Alfred H. Schütte, of Cologne, Germany, successor to Schuckhardt & Schütte in Western Continental Europe, who were the pioneers and largest handlers of American machine tools, etc., on the Continent. Mr. T. H. Marburg, the American representative of Mr. Schütte, whose New York offices are in the Havemeyer Building, has just returned from an extensive trip through the Central and Western States, where he went primarily for the purpose of selecting machinery and arranging for its shipment to Liège.

ST. PETERSBURG TROLLEYS.—A dispatch from Pittsburg says the plan involving the construction of 250 miles of electric trolley lines in St. Petersburg has been shelved for the time being at least. Had it not been for the uprising it is likely that the contract would have been closed before the end of next month. Murray Verner, of Pittsburg, has been in Russia for the last several months negotiating with the heads of the government and less than two weeks ago it was said the transaction had been practically closed. One of the interests of the enterprise says that negotiations cannot be resumed until normal conditions again prevail in Russia. It is the purpose of the Americans interested in the line to expend $50,000,000 in the construction of a complete electric railway system in St. Petersburg. That amount has already been pledged.

GREAT NORTHERN POWER PLANT.—It is stated in Minneapolis that the contracts for the dam, canal and power station of the Great Northern Power Company have been let to the Railway Construction Company, of New York. This is the first of a series of contracts that will involve the expenditure of about $3,000,000 in all. The St. Louis River back of Duluth, Minn., affords opportunity for the development of an immense power, the expectation being for 100,000 horse-power finally. Officers of the Great Northern Power Company are C. A. Duncan, of Duluth, president; C. D. Barney, of New York, vice-president; M. Tucker, of Tucker, Anthony & Co., Boston, treasurer.

TWO-PHASE PLANT FOR SOUTH AMERICA.—A central station plant of fair proportions, to be located in one of the more important towns on the west coast of South America, will be equipped with Westinghouse two-phase machinery, etc., throughout. The contract secured by Mr. J. K. Robinson, of Iquique, Chili, calls for a 360-kw plant. There will be three 175-hp engines arranged for direct connection to 120-kw, 1,100-volt generators. Included in the contract are 150 arc lamps—alternating current—regulating transformers, switchboard, panels, etc.

SINALOA WATER POWER SCHEME.—Application has been submitted to and is under consideration by the Mexican Government with a view of securing a concession which will permit of the construction of a water power plant on the River Fuerte, Municipality of Hurtis, State of Sinaloa. Mr. James Francis O'Gorman is the leading man in the project. About 10,000 liters of water per second will be made use of. The power is intended for general motive purposes, including the operation of big smelters.

STEAM TURBINE OUTFITS FOR MEXICO.—The Transvaal Copper Company, which operates an extensive mining property in Mexico, has placed a contract for a 175-kw twin type, three-wire system, 250 volt, 1200 r.p.m. steam turbine generator; also a 30-hp motor pump to operate 300 gallons per minute against a head of 180 feet. Mr. Victor Gutierrez, of Mexico City, has also ordered a similar outfit, consisting of a 75-hp turbine lift pump to work against a head of 30 feet.

ELECTRICAL EQUIPMENT FOR CEMENT COMPANY.—The contract for electrical machinery to be installed by the Alpha Portland Cement Company, of Easton, Pa., has been awarded to the C. & C. Electric Company, as already noted. The generating plant will consist of two 275-kw and one 75-kw, 250-volt belted dynamos, a total of 625 kw; and seven motors aggregating 510 hp, as follows: one 250-hp, one 80-hp, three 50-hp, one 20-hp, and one 10-hp.

MEXICAN HYDRO-ELECTRIC PROJECT.—A large hydro-electric plant is to be constructed on the Mexcala (or Balsas) River, State of Guerrero, Mexico. The power will be utilized for motive purposes. Mr. David Reyes Retana is primarily interested in the concession which has just been obtained from the Mexican authorities. It is proposed to use not less than 70,000 liters of water per second.

B. R. T. POWER HOUSE.—One of the chief items in the improvement plans of the Brooklyn Rapid Transit Company is the construction of a $6,000,000 power house with a capacity of about 100,000 horse power, in the Williamsburg division.

PLANT FOR MACKINAW, ILL.—The Mackinaw, Ill., Electric Company has just placed contracts for the equipment of its plant. A Bates Corliss engine of 140 hp capacity, to be direct-connected to a Fort Wayne alternating current dynamo, has been ordered.

LIGHTING PLANT FOR MEXICAN PLANTATION.—The Continental Mexican Rubber Company, of Torreon, Mexico, is to instal a lighting plant. The engine has just been ordered from the Ames Iron Works, Singer Building. It will be a 100-hp machine.

VERA CRUZ HYDRO-ELECTRIC PROJECT.—Mr. Manuel Alonzo, of Vera Cruz City, Mexico, is primarily interested in a project to build a big hydro-electric plant on the Antigua River at a point about 20 miles from Vera Cruz. Application has already been made to the Mexican Government for the necessary concession.

HEATERS FOR JAPANESE ARSENALS.—The Goubert Manufacturing Company, Singer Building, New York City, has secured orders, at the instance of the Japanese Government, for a number of large heaters to be installed in the Kobe and other big arsenals.

NEW ROBB-MUMFORD BOILER PLANT.—The Robb-Mumford Boiler Company, New York offices, 135 Broadway, is to build a good-sized electrically operated plant at South Framingham, Mass., for the manufacture of the Mumford internally-fired boiler. The electric equipment will be about 300 hp capacity.

EQUIPMENT FOR ALAMEDA, CAL.—The municipal electric plant at Alameda, Cal., is to be installed with a 240-kw National Electric generator arranged for direct connection to a Harrisburg-Fleming tandem compound engine. The contract was secured by the Charles C. Moore Co., of San Francisco. The contract price was $12,607.

NEW BARCLAY BUILDING.—Pattison Bros., the consulting electrical engineers, have contracted for the Admiralty oiling system to be installed on all the machinery in the power and lighting plant of the new Barclay Building, Broadway and Duane streets, New York City. The J. H. Siegrist Co. received the contract for the apparatus.

McCORMICK TURBINES FOR JAPAN.—Two 33-inch McCormick turbines, built by the S. Morgan Smith Co., of York, Pa., are to be exported to Japan. The contract was secured through the British electrical engineering and contracting firm of L. J. Healing & Co., of Yokohama, represented on this side by Mr. Francis A. Cundill, of 96 Wall Street.

ELECTRICALLY DRIVEN TOOLS FOR CHILI.—The export house of Kates & Bok, Orient Building, which buys considerable electrical machinery, supplies, etc., for the Venezuela, Argentina and Chilian markets, is figuring on a substantial contract for electrically driven machine tools, shapers, millers, etc., for installation in Chilian government railroad shops.

TURBINE PUMPING PLANT FOR MEXICO.—A steam turbine pumping installation to be used for irrigation purposes, has been ordered for erection in the vicinity of Irapuato, Mexico. The turbine will be of De Laval build. The boiler for the plant has been ordered from the Robb-Mumford Boiler Company, through its New York manager, Mr. George F. Tremain, 135 Broadway.

LIGHTING PLANT FOR CHAPALA.—Mexican advices state that the government of the State of Jalisco has granted a concession to Carlos Navarro Mora, of Guadalajara, which permits of the establishment of a big plant at Chapala, the Saratoga of the southern republic. The plant will generate current for lighting the city of Chapala and the cottages on the shore of Lake Chapala.

LIGHTING PLANT FOR PUERTO CABELLO.—Orders have been placed for the equipment of a lighting plant to be built at Puerto Cabello, the port of Caracas, the capital of Venezuela. The initial equipment will aggregate about 300 kw. The order for the generators went to the Stanley Electric & Manufacturing Company. These machines will be arranged for direct connection to gas engines built by Neville Brothers, Liverpool, England. The export house of Kates & Bok, Orient Building, placed the orders.

PHILIPPINE WATER POWER PROJECT.—The construction of a fair-sized water power plant is contemplated on the Ibiang, Munti and Ibiag Malaqui Rivers, located between the towns of Lueban and Tabayas, Philippine Islands, for the purpose of generating electric energy. Mr. Ignacio Arnalot, of Tabayas, has been granted the necessary concession by the proper authorities—the Philippine Commission. He proposes to utilize the power for operating his factory. The franchise also permits him to furnish power to the public, subject to the tariff regulations of the Commission.

ANNUAL EXPORTS.—The total domestic United States exports for 1904 were $1,425,748,138, as compared with $1,457,647,183 in 1903. The slight falling off indicated was wholly in agricultural products, which were $794,736,646, as compared with $913,655,889. On the other hand, manufactured products showed a splendid gain, being $502,764,729 in 1904, as compared with $421,453,915 in 1903. The imports for 1904 were $1,035,909,197, leaving a credit balance to export trade in 1904 of $389,838,941. It had been expected that this would be much larger, but toward the end of the year the agricultural exports did not hold up.

EQUIPMENT FOR LAWYERS' TITLE INSURANCE COMPANY.—The Lawyers' Title Insurance Company's new building, Brooklyn, is to be equipped with a lighting plant of 120 hp. The machinery will include an Ames single cylinder high-speed engine, arranged for direct connection to a 75-kw Westinghouse, 120-volt, 275-r.p.m. generator. Helme, Huberty & Hudswell, Temple Court Building, Court Street, Brooklyn, are the architects. In the same company's building, at 46 Maiden Lane, a 120-hp Ames single-cylinder, high-speed engine, directly coupled to an 85-kw Westinghouse, 120-volt, 275-r.p.m. generator, will be put in. This equipment will also be utilized for lighting purposes.

MORE EQUIPMENT FOR SEOUL.—The electric power plant at Seoul, the capital of Korea, which generates current for operating the lighting and street railway systems, is to be enlarged, and contracts are to be closed here very shortly for 500-kw of equipment. There will be two additional generating units installed, each of 250-kw capacity. The company operating the plant was recently reorganized under the laws of the State of Connecticut. The old concern was called the Seoul Electric Company. The style of the new company is the American Korean Electric Company. It has a fully paid up capital of $1,000,000—United States currency. The capital stock is held in about equal proportions by the American contracting firm of Collbran & Bostwick, of Seoul, and the Emperor of Korea. Frazar & Company, of Japan, 63 Wall Street, placed the contract here for a large portion of the initial plant.

REPORT QUITO CONTRACT DENIED.—The daily press reports to the effect that J. G. White & Co. have secured a contract from the Government of Ecuador for the construction of a $1,000,000 electric lighting and traction system in Quito, the capital of the republic, are without any foundation, according to Mr. H. S. Collette, the secretary of the company. Quito is located at an altitude of about 8,000 feet above sea level, and is some two hundred miles distant from Guayaquil, the principal seaport of Ecuador. The capital is without railroad facilities of any description, and it would be a physical impossibility to get any heavy machinery there under existing conditions. Moreover, there is no immediate call for a lighting and traction system in Quito as everything is conducted there in the most primitive fashion. The press report probably is intended to refer to the Montevideo contract, the J. G. White & Co., of London, having lately secured a contract for the building of a big electric traction system in that South American city.

CUBAN ELECTRIC RAILWAY.—At Santiago, Cuba, there has been organized a joint stock company called the Compaña Eléctrica de Santiago, with a capital stock of $300,000 and an authorized bond issue of $300,000 additional. Mr. José Marimon is president, and Mr. Eduardo J. Chibas, vice-president and managing director. The company operates under a concession given by the president and secretary of government of the Republic and a charter granted by the municipality of Santiago de Cuba. The company proposes to build immediately a plant to supply light and power to private consumers and later to construct a street and suburban railway. The following contracts have been let: To the Babcock & Wilcox Co., of New York, for supplying three boilers of 500 horse-power and one steel smokestack 110 feet high; to the Buckeye Engine Company, of Salem, Ohio, for supplying two stationary engines of 235 horse-power each; to the General Electric Company, of New York, for supplying all the electrical machinery necessary for the equipment of the plant.

CALIFORNIA GAS & ELECTRIC CORPORATION.—After several years of negotiations the entire capital stock of the South Yuba Water Company and its subsidiary company, the Central California Electric Company has been transferred by Dr. Charles Van Norden, of Sacramento, and Warner Van Norden, of New York, to the California Gas & Electric Corporation. The terms are private, but are supposed to exceed $1,000,000. The control of the supply of mountain water to which the South Yuba Water Company held the water rights, was of prime importance to the California Gas & Electric Corporation, as if secured by a rival concern, it would have meant competition in profitable territory. For some months past the greater part of the outturn of the three electric power plants operated by the Central California Electric Company in Placer County has been purchased by the California Gas & Electric Corporation, which also had an option on the entire property. These plants are located at Alta, Auburn and Newcastle, respectively. It is understood that the offices of the South Yuba system will remain in Sacramento, but after a short time Dr. Charles Van Norden will retire from the management.

POWER DEVELOPMENT IN MISSOURI.—Work on the sub-station that the Spring River Power Company is building near Joplin, Mo., is complete and arrangements will be made to turn on power early in February. This is one of four sub-stations, each of 750-kw capacity, that are to be supplied from a power plant at Lowell, Kan., where generator capacity of 3000 kilowatts, direct-connected to water turbine, is installed. Power is to be supplied to the zinc mines in this section. The engineering as well as the entire work of construction in connection with this development has been done by the Arnold Electric Power Station Company, of Chicago.

SOUTHERN TROLLEY EXTENSION.—Activity is being shown in different parts of the South in plans for the construction of electric railways. Among those reported since the first of the year in the *Manufacturer's Record* is one for which the right of way is now being secured between Corsicana and Fairfield, Texas, a distance of 32 miles through a territory now without a railroad, but thickly settled by fruit raisers and truck growers. About 3500 miles of railroad construction in the South is planned for this year, including new lines and extensions.

SOME WATSON-FLAGG CONTRACTS.—The Watson-Flagg Engineering Company, Thames Building, has secured a contract for the lighting and wiring of the Georgia Railway Company's new terminal at Atlanta. The contract for the wiring of the nineteen-story Chandler office building at Atlanta has also been secured by the Watson-Flagg people, who will also execute the wiring work in the new office building of the Fidelity Safe Deposit & Trust Company, Baltimore, Md.

PLANT FOR NEW POLICE HEADQUARTERS.—The electrical equipment to be installed in the new Police Headquarters on the site of Centre Market at Broome and Centre Streets, will be of 375-hp capacity. There will be two 150-hp engines, arranged for direct connection to 100-kw generators, and one 75-hp engine to be direct-coupled to a 50-kw generator. Clark & MacMullen, 22 Broad Street, have been retained as electrical engineers on the work.

EQUIPMENT FOR FISHER LOFT BUILDING.—The contracts have just been awarded for the electrical plant to be installed in the Fisher loft building, at 97-103 East Houston Street. The generators will be Western Electric, and are to be direct connected to Watertown engines. Mr. C. O. Mailloux, Bishop Building, William Street, is the consulting engineer on the work.

EQUIPMENT FOR LOFT BUILDING.—A large loft building is to be built at Fifth Avenue and Eighteenth Street by the Fifth Avenue & Eighteenth Street Realty Company, of which Mr. Henry Conn, of 1170 Broadway, is president. A good-sized electrical equipment will go in. Maynicke & Frank, 298 Fifth Avenue, have been appointed the architects.

EQUIPMENT FOR APARTMENT HOTEL.—Contracts will be awarded for the electrical equipment to be installed in the $1,250,000 apartment hotel to be built at Central Park West, between Seventy-third and Seventy-fourth Streets, by the real estate firm of Boehm & Coon, 31 Nassau Street. Clinton & Russell are the architects.

EQUIPMENT FOR LAWRENCE CORDAGE WORKS.—The Lawrence Cordage Works, of Jersey City, are to have a 450-kw three-phase plant. The General Electric Company secured the contract for the generating equipment and McIntosh, Seymour & Company got the engine contract.

PLANT FOR SOCIETY BUILDING.—The New York Historical Society is to construct a building at Central Park West, between Seventy-sixth and Seventy-seventh Street, in which a good-sized electrical plant is expected to be put down. York & Sawyer, of 156 Fifth Avenue, are the architects.

EQUIPMENT FOR HEBREW ASYLUM.—The Hebrew Orphan Asylum, Pacific and Dean Streets, Brooklyn, is to have a separate lighting plant consisting of a 60-hp Harrisburg-Fleming side crank engine, direct-connected to a 125-volt, 275 r.p.m. Westinghouse generator.

PLANS FOR NEW ALTMAN STORE.—The plans for the construction of the big department store to be constructed on Fifth Avenue, between Thirty-fourth and Thirty-fifth Streets, by B. Altman & Company, are being prepared by Trowbridge & Livingston.

PLANT FOR STATEN ISLAND.—Mr. Frank Sutton, of 91 Wall Street, New York City, has been retained as electrical expert for the installation of the lighting plant to go in the big institution building to be constructed at Mount Kovetto, Staten Island.

PLANT FOR APARTMENT HOUSE.—A big batchelor apartment house is to be built at 644 Madison Avenue by Mr. Robert M. Tailer, of 76 William Street. A lighting plant will be installed. Mr. Chas. T. Rose, 1 Madison Avenue, is the architect.

EQUIPMENT FOR COMMERCIAL CABLE ANNEX.—The Commercial Cable Company is to build a large annex to its Broad Street office building. Mr. E. Nielsen, Room 1915, No. 20 Broad Street, will have charge of the electrical installation work.

PLANT FOR BROOKLYN CAPSULE FACTORY.—H. Planten & Son are to build an electrically operated gelatine capsule factory at 93 Henry Street, Brooklyn. Mr. Louis Giller, 416 Broadway, has been chosen to act as the architect.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market at the end of the week was steady with a new renewed strong undertone. The foreign political complications and the attendant anxiety in foreign financial centres had some effect on the New York market early in the week. For a time support was withdrawn and buying power was suspended, the professional element becoming generally bearish. Later, the market rallied and regained a large part of the earlier losses. There were few incidents of any importance in the week's developments. Among the industrials there was little activity apart from the renewal of manipulation in Amalgamated Copper, which caused it to advance rapidly on Thursday. The market for electric and traction stocks was featureless. There was a good business done in General Electric, however, at prices ranging between 181½ and 187, the closing quotation being 185½, a net loss of 1½ points. Allis-Chalmers, both common and preferred, made net gains on the week's business, the former of 1 point, and the latter 1½, closing at 16½ and 65½, respectively. Westinghouse common is up ¾ of a point, and preferred dropped 1 point, the closing quotations being 180¾ and 192. Western Union Telegraph closed at 92¾, a net loss of ⅛ point; American Telephone & Telegraph, 144½, a decline of 1½ points, and American Telegraph & Cable, 95, a gain of 1½. Among the tractions Metropolitan Street Railway closed at 116¼, which is a net gain of ¼ point. Interborough Rapid Transit made another sharp advance and reached 202⅜, the closing quotation being 200¼, which is a net gain of 2¼ points. Brooklyn Rapid Transit closed at 61, this representing a net loss of 1¼ points. The curb market ended the week with a steady undertone with some firm features including the sharp rise of Interborough Rapid Transit. Following are the closing quotations on the Stock Exchange, January 31:

NEW YORK

	Jan. 24	Jan. 31		Jan. 24	Jan. 31
Allis-Chalmers Co.	12	15¼	Electric Vehicle	13½	14⅜
Allis-Chalmers Co. pfd.	62	62	Electric Vehicle pfd.	24	24
American Tel. & Cable.	94⅜	94	General Electric.	181¾	186
American Tel. & Tel.	143	145	Hudson River Tel.	..	..
American Dist. Tel.	..	..	Interborough Rap. Tran.	197	202⅛
Brooklyn Rapid Transit.	60⅛	60⅜	Metropolitan St. Ry.	116⅛	116
Commercial Cable.	..	..	N. Y. & N. J Tel.	..	..
Electric Boat	42	38	Marconi Tel.	..	..
Electric Boat pfd.	79	76	Western Union Tel.	92	92
Electric Lead Reduction.	⅛	⅛	Westinghouse com	176	179
			Westinghouse pfd	190	190

BOSTON

	Jan. 24	Jan. 31		Jan. 24	Jan. 31
American Tel. & Tel.	142⅛	145	Western Tel. & Tel. pfd.	*97½	98
Cumberland Telephone.	120	120	Mexican Telephone.	1⅜	1⅝
Edison Elec. Illum.	254⅛	251	New England Telephone.	138⅛	*138
General Electric	183	185⅛	Mass. Elec. Ry.	15	15
Western Tel. & Tel.	18	18	Mass. Elec Ry. pfd.	60	

PHILADELPHIA

	Jan. 24	Jan. 31		Jan. 24	Jan. 31
American Railways.	48	48	Phila. Traction.	99¾	100¼
Elec. Storage Battery.	78⅛	75	Phila. Electric.	9⅞	10
Elec. Storage Battery pfd.	76½	75	Phila. Rapid Trans.	24	24⅞
Elec. Co. of America.	10⅝	10½			

CHICAGO

	Jan. 24	Jan. 31		Jan. 24	Jan. 31
Central Union Tel.	..	..	National Carbon pfd.	113	114
Chicago Edison.	..	..	Metropolitan Elev. com.	20⅛	20⅛
Chicago City Ry.	*197⅛	198	Union Traction.	*12	..
Chicago Tel. Co.	..	..	Union Traction pfd.	*48	..
National Carbon.	41	40⅛			

* Asked.

ANOTHER NEW YORK ELEVATED.—A letter read at the Mount Vernon taxpayers' meeting in the Fourth Ward brought out the fact that the New York and Harlem Railroad Company is contemplating the erection of a four-track elevated system through Mount Vernon when it begins using electricity on its local trains between the Grand Central Station and White Plains. The company's proposition is to build a four-track elevated railroad from Wakefield to Fleetwood, similar to its viaduct in Harlem, and do away with every grade crossing in the city provided the municipality will co-operate with it to the extent of $75,000. The matter will be brought before the Board of Aldermen at the next meeting. The length of the viaduct if built will be more than a mile, and it is estimated it will cost $500,000.

MASSACHUSETTS ELECTRIC COMPANIES report their gross trolley earnings for the last quarter as $1,458,967, as compared with $1,450,013 in 1903. Expenses were $1,036,658, as compared with $1,025,552.

DIVIDENDS.—The directors of the Butte Electric & Power Company have declared a quarterly dividend of 1¼ per cent. on the preferred stock, payable February 1.

NORTH AMERICAN IN ST. LOUIS.—While it is understood that the North American Company is favorable to taking over the outstanding stock of the Laclede Gas Company and the Union Electric Light, Heat & Power Company of St. Louis, it is denied that anything definite has been done.

CHICAGO COMMONWEALTH CAPITAL.—The Commonwealth Electric Company has increased its capital stock by $750,000, the new issue being taken at par by the Chicago Edison Company, which holds, through trustees, all the stock of the Commonwealth Company. The price of the $500,000 first mortgage 5s recently sold by the Commonwealth Company to N. W. Harris & Company was 107¼. The company is doing a large and growing business.

COMPETITION AT SPRINGFIELD, OHIO.—Dispatches from Springfield, Ohio, state that the People's Heat, Light & Power Company, capital $1,500,000, has been organized and will compete with the company which has been alone in the local lighting business. The old corporation is the Springfield Light & Power Company, with a capital authorized of $200,000..

STANDARD UNDERGROUND CABLE.—The annual report of the Standard Underground Cable Company shows gross earnings for 1904 of $8,571,533, against $8,685,294 in 1903. The company paid 12 per cent. in dividends on its $2,000,000 capital, amounting to $240,000 and carried the remainder of earnings to surplus. The company has no bonded or floating debt. Unfilled orders on hand at the beginning of the new fiscal year January 1, 1905, were in excess of $1,000,000 and a fair volume of business has been booked thus far in January.

CHICAGO ELEVATED FIGURES.—The South Side Elevated Railroad of Chicago has issued its annual report for the year ended December 31, 1904. The income account compares as follows:

	1904	1903	1902.	1901.
Gross	$1,574,829	$1,679,310	$1,483,843	$1,362,231
Expenses and taxes	969,975	994,376	862,338	844,960
Net	$604,854	$684,934	$621,505	$517,271
Interest and dividends	442,899	442,883	442,874	391,705
Surplus	$161,955	$242,051	$178,631	$125,566

WAGNER ANNUAL REPORT.—The annual meeting of the Wagner Electric Manufacturing Company, of St. Louis, resulted in the election of the following officers and board: S. M. Dodd, president; James W. Bell, vice-president; Albert Blair, secretary; J. C. Van Blarcom, James Campbell, S. B. Pike and W. A. Layman, treasurer and manager. The total volume of the business done by this company during the year 1904 showed a handsome increase over the preceding year. The board has authorized 1905 quarterly dividends of 1¾ per cent., payable January 24, April 1, July 1 and October 1.

JACKSONVILLE ELECTRIC PROSPEROUS.—The Jacksonville Electric Company has declared a semi-annual dividend of $3 per share on the preferred stock and $2 per share on the common stick. The dividend on the common is the initial distribution on that class, but the company has paid 3 per cent. semi-annually on the preferred stock since February, 1903. This property was bought by Stone & Webster early in 1902, and had at that time gross earnings of $169,000. The first year under their management the results were: Gross, $200,000; net, $62,000. For the twelve months ending December 31, 1904, the gross was $290,000; net, $114,000.

ALLEGED BELL MERGER.—The announcement is made through the Pittsburg *Press*, that a combination of the forty-three leading telephone companies of the United States has been effected and that when the annual meeting of the American Telephone & Telegraph Company of New York is held in Boston next month it will be made public. The combined capital of the companies mentioned is placed at $250,000,000. The *Press* says: "In many of the companies coming into the new arrangement the American Telephone & Telegraph Company owns a majority of the stock, common and preferred, and in the remaining instances the companies drawn together are controlled through a scheme of license agreements which are of mutual benefit to the corporations and the New York concern." This report has been denied, among others by Mr. E. M. Barton, president of the Western Electric Company, in Chicago.

WINNINGS IN INTERBOROUGH.—The *Wall Street Journal* has the following calculation about profits in Interborough: "The Rapid Transit Subway Construction Company, incorporated in February, 1900, was taken over in May, 1902 by Interborough Rapid Transit, which had just been incorporated with a capital of $25,000,000. The Subway Construction Company had a capitalization of $6,000,000, which, at the time it was taken over, was 60 per cent. paid. Its stockholders were given the privilege to exchange for Interborough stock on the basis of $160 in the latter for each $100 share of their original holdings. They were also given dollar for dollar in Interborough stock for the unpaid balance of subscriptions. This meant that $13,600,000 in Interborough stock was exchanged for $6,000,000 Subway Construction stock. On this basis the original subscriber to 100 shares of Subway Construction received 226⅔ shares of Interborough in exchange for his full paid stock. He was also allowed to subscribe for 150 shares of Interborough at par which left him with 376⅔ shares of the latter for which he had paid in all $25,000. There was also about this time a sale of $2,450,000 Interborough stock at 110, but it is thought this went mainly to some new interest. When the stock was increased from $25,000,000 to $35,000,000 the additional $10,000,000 was sold to stockholders at par in proportion to the amount of their holdings. The original holder of 100 shares of Interborough who had accepted his former privilege to subscribe at par now holding 376⅔ shares was entitled to subscribe for 150⅔ shares at par involving an additional investment of $15,066. This left him with 527⅓ shares which had cost him in the aggregate, disregarding interest, $40,066. The stock last week crossed $200 a share. Assuming that it should maintain something about that level, the 527⅓ shares would be worth $105,466. As the stock cost the investor, in the case we have supposed, only $40,066, it is evident that there is a profit of $65,400, or 163 per cent.

BRITISH THOMSON-HOUSTON.—The annual report recently received is an encouraging document, and was presented to the stockholders December 15, but apparently it includes no figures later than for the year ending March 31, 1904. A gross profit on sales, etc., was shown of £182,570. The net profits, after deducting general and technical expenses, discounts and interest, amount to £55,713 8s 1d., applied as shown in the balance sheet and profit and loss account, leaving a balance of £2,821 16s. 2d. to be carried to the next year's accounts. As shown by the balance sheet, the excess costs of manufacture incidental to the establishment of the manufacturing business of the company to date amount to £63,326 15s. 6d. Of this amount £20,000 is now written off, and further amounts will be written off until finally disposed of.

WASHINGTON TRACTION FIGURES.—The Capitol Traction Company, of Washington, D. C., has issued its pamphlet report for the year ended December 31, 1904. The income account compares as follows:

	1904.	1903.	1902.	1901.
Gross	$1,517,371	$1,413,312	$1,381,033	$1,231,683
Expenses	633,706	590,938	631,987	560,171
Net	$883,665	$822,374	$749,046	$671,512
Other income	18,718	21,741	21,007	19,677
Total income	$902,383	$844,115	$770,053	$691,189
Charges, taxes, etc.	137,188	114,187	116,105	111,800
Balance	$765,195	$729,928	$653,948	$579,389
Dividends	600,000	600,000	480,000	480,000
Surplus	$165,195	$129,928	$173,948	$99,389

KEYSTONE TELEPHONE REPORT.—The general balance sheet of the New Jersey (parent) Corporation as of December 31, 1904, shows as follows:

	1904. Dec. 31.	1903. Dec. 31.
Assets:		
Common stock Keystone Tel. Co. of Phila.	$4,432,712	$4,433,712
First mortgage of Keystone Tel. Co. of Phila.	2,500,000	2,500,000
Current assets	546,406	439,982
Prepaid taxes	2,413	2,408
Total	$7,482,531	$7,376,102
Liabilities:		
Preferred stock	$1,936,850	$1,936,800
Common stock	5,000,000	5,000,000
Current liabilities	300,000	312,636
Accrued liabilities	8,150	8,150
Undivided profits	116,857	.....
Interest received	120,674	118,516
Total	$7,482,531	$7,376,102

TOLEDO RAILWAYS LIGHT.—The Toledo Railways & Light Company showed during the year ended December 31, 1904, profits equal to 2¾ per cent. on the capital stock, compared with 2⅔ per cent. in 1903, 2¼ per cent. in 1902 and 2⅛ per cent. in 1901. The outstanding bonded debt of the company is $10,020,000, and in addition $833,000 of bonds are in the treasury to be used for betterments and extensions at the rate of 75 per cent. of actual cost. President Everett points out in his annual statement that the flood during January and February, 1904, interfered with operations, resulting in a decrease in earnings. The company laid 7⅓ miles of new track during the year, the mileage operated during the year being 105¾ miles. A contract was made with the Toledo, Port Clinton & Lake Side Railway Company to enter Toledo over the company's tracks. There are now seven interurban roads using the company's lines. The company furnishes the city with 1265 arc lamps and commercial current for 138,270 incandescent lamps and for 5468 h p motors.

General News of the Week

The Telephone.

LITTLE ROCK, ARK.—The Lawrence County Telephone Company has filed with the Secretary of State a certificate of increase of capital stock from $3000 to $25,000.

LONOKE, ARK.—The directors of the Jacksonville Telephone Company have decided to run the line to Lonoke and put in an exchange at this place, which will have long-distance connection with Little Rock. This will make two systems at this place. This new system is backed by John Bowers, Sr., and Dr. Murtishaw and many of the most substantial business men of the county.

GLENWOOD SPRINGS, COL.—The Colorado Telephone Company has purchased the Western Slope Telephone Company.

PERRY, FLA.—Mr. W. A. Hendy, a local capitalist, and the allied interest have bought the entire stock in the Perry Telephone Company, excepting that of J. T. Blair.

MIAMI, FLA.—H. C. Budge and associates have applied to the City Council for a charter to establish another telephone system in the city of Miami. This new company proposes to furnish a thoroughly up-to-date system.

VIRGINIA, ILL.—John G. Pratt, of the Cass County Telephone Company, has purchased the Bell Telephone local exchange and consolidated the two lines.

FIELDON, ILL.—The Western Telephone Company, of this city, has been formed. Capital, $960. The incorporators are F. F. Loellke, F. A. Marks and others.

LEXINGTON, ILL.—The Prairie Hall Telephone Company has been organized. G. K. Elder, John A. Moon and George C. Elder are the incorporators.

SPRINGFIELD, ILL.—Senator Burnett introduced a bill into the Senate giving municipal corporations authority to fix and regulate the price of telephone rates.

KIRKSVILLE, ILL.—The Kirksville Mutual Telephone Company has been chartered, capital $2400, to operate a system of telephones. The incorporators are O. M. Hale, E. R. Boggs and others.

NASHVILLE, ILL.—The Nashville Mutual Rural Telephone Company has been formed with the following-named officers: President, J. J. Randall; treasurer, Samuel T. McKelvey; secretary, Christ. Buhrmeister.

ALBION, ILL.—The Edwards County Telephone Company held its annual meeting in this city. An entire new board of directors was elected and the company reorganized. Charles Clark was elected president; Moses Gumbriell, treasurer, and O. A. Bunting, secretary.

QUINCY, ILL.—The Quincy Automatic Telephone Company has been granted an additional four months, or until May 19, 1905, in which to begin the work of constructing its plant. The present condition of the weather is unfavorable for the excavations necessary, and for that reason the extension of time was asked.

CLARK'S HILL, IND.—At a meeting of the Co-operative Telephone Company, A. F. Yeaman was chosen president, William Wiggs, secretary, and M. B. Loveless, treasurer.

ELKHART, IND.—The Home Telephone Company has elected the following-named officers: President, I. W. Short, Elkhart; vice-president, J. A. Arthur, Goshen; treasurer, H. B. Sykes, Elkhart; secretary and manager, J. K. Johnston, Elkhart.

ELKHART, IND.—The directors of the Home Telephone Company, of Elkhart and Goshen, at their annual meeting elected the following officers: I. W. Short, president; Jas. A. Arthur, vice-president; H. B. Sykes, treasurer; J. K. Johnston, secretary and manager. There was shown to be a net surplus for the year of $10,293.10, and an increase of 499 telephones. A new "multiple" switchboard will be installed at Goshen at once and the service greatly improved.

PANAMA, IA.—The Panama & Merchants' Telephone Company plans numerous extensions to its lines.

DES MOINES, IA.—The Marne and Elkhorn Telephone Company has increased its capital to $15,000.

DES MOINES, IA.—The St. Charles and Truro Farmers' Mutual Telephone Company, capital, $800, has been incorporated by J. D. Clayton and others.

DES MOINES, IA.—The Flat Independent Telephone Company, of this city, has been formed; capital, $1200. The incorporators are B. C. Way and others.

IVESTER, IA.—The Ivester Mutual Telephone Company has held its annual meeting. The present officers were all re-elected except the vice-president. John Cone was elected instead of J. F. Strickler.

EUREKA CENTER, IA.—The Short Pole Telephone Company has held its regular meeting and elected officers for the ensuing year as follows: Mr. Hollinrake, president; A. Tharp, secretary; J. C. Bang, treasurer.

ALBION, IA.—At the annual meeting of the Farmers' Mutual Telephone Company officers for the ensuing year were elected as follows: President, A. C. Diller; vice-president, W. T. Gough; secretary and treasurer, P. L. Collins.

COUNCIL BLUFFS, IA.—F. J. Day has been elected president of the independent Telephone Company in place of E. H. Lougee, and C. A. Beno secretary in place of Mr. Day. E. H. Merriam was re-elected vice-president and T. G. Turner, treasurer.

DES MOINES, IA.—The Iowa Telephone Company is preparing to construct eight toll lines out of Des Moines, commencing early in the spring. They are to be "trunk lines," or lines devoted exclusively to the business of larger towns, turning the smaller towns in on the circuits now in operation. Sioux City, Omaha, Davenport, Clinton and Dubupue will probably be terminals of five of the lines, while other lines will probably extend north to trunk business to Minneapolis and St. Paul, and south in the direction of Kansas City and St. Louis.

CONCORDIA, KAN.—The Concordia Telephone Company has passed into the control of a new company, of which F. W. Daugherty is president.

ABILENE, KAN.—Four new telephone lines in the county townships have been begun this month. A line will be extended from Wakefield to Buckeye, six miles north of Abilene. A line will probably be built to Junction City from the north part of the county.

LEAVENWORTH, KAN.—Between now and March 1 every telephone in this city on the lines of the Missouri & Kansas Telephone Company will be taken out and replaced with the new central energy telephones. About that time the telephone company expects to be in its new building on Deleware Street with its new plant in running order and a completely new telephone system over the city.

HOWELL, MICH.—At the annual meeting of the Livingston Mutual Telephone Company the following officers were elected: President, H. W. Norton, Marion; vice-president, E. A. Kuhn, Gregory; secretary, H. E. Reed, Marion; treasurer, A. J. Van Patten.

TAWAS, MICH.—Extensive improvements and additions in the Tawas City and East Tawas telephone service are being made. The Michigan Company is making improvements and perfecting its system all over the eastern part of the State. Twenty thousand feet of cable will be strung.

CAMDEN, MICH.—The Camden Rural Telephone Company, of Camden, Henry Haynes, president; S. E. Haughey, secretary; B. R. Alward, treasurer, incorporated 18 month ago with a capital stock of $10,000 has experienced a remarkable growth. This company has erected 150 miles of poles and is now operating over 300 miles of lines; in addition it has over 50 contracts for telephones not yet installed. It is the terminal office of the three outside lines with which it connects. It has an exchange at Frontier, Mich., and is soon to open an exchange at Montgomery, Mich. A meeting is called for Feb. 1 for the purpose of increasing the capital stock.

SAGINAW, MICH.—The annual meeting of the Valley Telephone Company has been held. Reports for the year showed the income to be $90,669.07, an increase over 1903 of $12,222.42. The investment was increased $41,343.21, it now being $441,490.07. Dividends paid during the year amounted tc $16,244.49. The number of telephones in use is 4471, an increase during the year of 552. The officers are: Jas. Davidson, president; John L. Jackson, vice-president; Chas. B. Curtis, treasurer; R. P. Johnson, secretary and general manager. The company will be reorganized as the Saginaw Valley Telephone Company, with an increase of the capital stock from $250,600 to $850,000, of which $350,000 will be preferred at 6 per cent. and $500,000 common. It is believed the recent activity of representatives of the Citizens' Telephone Company, of Grand Rapids, the largest independent system in the State, has some bearing on the reorganization, as Joseph B. Ware, of Grand Rapids, will be on the new company's board of directors.

CLARA CITY, MINN.—A local company is to be formed to build a telephone exchange. C. Burghuis is interested.

HOLLOWAY, MINN.—Wm. Windhurst contemplates the construction of a telephone line between here and Morton.

MILAN, MINN.—The Lacqui Parle County Farmers' Mutual Telephone Company's lines will be extended to this city.

GIBBON, MINN.—The Nicollet County Telephone Company is erecting a line into Moltke to be connected with the Stewart line.

WINDOM, MINN.—The Windom Mutual Telephone people have made a contract with the Fulda Telephone Company to connect at Westbrook for farm business between Westbrook and Dundee.

AMBOY, MINN.—At the annual meeting of the Willow Creek Telephone Company the following officers were elected for the ensuing year: President, Henry Day, Amboy; secretary, F. H. Barnes, Vernon Center; treasurer, O. H. Thompson, Ceresco.

HAMILTON, MONT.—The Rocky Mountain Bell Telephone Company intends to build an extension of their line from Hamilton to Darby.

MISSOULA, MONT.—The Rocky Mountain Bell Telephone Company will install exchanges at Victor and Stevensville, and will extend its long distance lines.

ROWENA, MO.—The Mutual Telephone Company, of Rowena, has arranged to build a telephone line from Rowena to Centralia.

SALINA, MO.—The Marion County Co-operative Telephone Company has elected these officers: Jacob Hersberger, president; H. R. Stevenson, vice-president; George White, secretary; John S. Stonecipher, treasurer; Jacob Herschberger, Dr. T. J. Green and John Daniels, directors. The company is now engaged in building its lines to this city, and will establish a central office.

JEFFERSON CITY, MO.—Mr. Elliott introduced a bill in the House requiring telegraph and telephone companies, whether incorporated or not, operating lines in this State, to keep its offices open all day and all night in cities of 9000 or more inhabitants, as shown by the last census. Failure to supply

sufficient facilities for the transmission of messages is punishable by a fine of $200, half of which goes to the complainants and half into the public school fund of the county.

BROKEN BOW, NEB.—The Central Telephone Company has increased its capital from $35,000 to $100,000.

ROCK CREEK, NEB.—The Rock Creek Telephone Company has filed articles of incorporation with the Secretary of State. Capital, $2000. The incorporators are G. S. Kugler, A. T. Ready and others.

ORANGE, N. J.—After having quibbled with the company for several years, the West Orange Town Council has passed on first reading an ordinance granting a franchise to operate in the town to the New York and New Jersey Telephone Company.

ELIZABETH, N. J.—The work of connecting the various towns in the circuit of the Interstate Telephone Company has been completed. From Elizabeth the new connecting line runs to Newark, Jersey City, Bound Brook, Metchuen and Trenton. The Trenton office connects with all the principal towns of South Jersey, Atlantic City, Cape May and the other sea coast cities. Continuing from Trenton, the line extends to Philadelphia and thence to all the towns in Pennsylvania. From Elizabeth to Bound Brook, and from Lyons Farms to Newark, the wires are strung over the right of way of the Lehigh Valley Railroad.

NEW YORK, N. Y.—The Rose Telephone Company has been formed, capital $15,000. Incorporators: H. K. Rose, Mary J. Rose, South Kortright, N. Y.; C. E. Hanford, Hobart, N. Y.

JOHNSTOWN, N. Y.—In view of the recent increase of rates of the Glen Telephone Company, of Johnstown, since its purchase by the Bell Telephone Company, of 100 per cent. on resident telephones and 75 per cent. on business telephones, the physicians of Johnstown have taken action and agreed to have their telephones removed rather than pay the rates demanded.

CORTLAND, N. Y.—Although the official announcement has not been made, it is understood that telephone rates in this city will be increased on or about July 1. The Cortland Home Telephone Company has made large expenditures of late in erecting a new building and installing a new switchboard. The higher rates are made necessary to keep the service at the top level of efficiency. The proposed changes in rates follow: Business telephones will be advanced from $24 to $36 a year; residence telephones from $12 to $18; two person lines from $12 to $15 a year.

MIDDLETOWN, N. Y.—A meeting of the stockholders of the Orange County Telephone Company has been held, when the proposition of the Hudson River Telephone Company offering terms for the consolidation of the two companies was accepted. The Orange County Company, which was organized to give Middletown good telephone service at reasonable rates, faced serious competition in the project of the Hudson River Telephone Company to build a modern plant costing $75,000. By the consolidation, the Orange County Company combines local and long distance service.

PORT JERVIS, N. Y.—It is stated that the Port Jervis Telephone Company will be united with the Hudson River Telephone Company.

GREENSBORO, N. C.—The Southern Bell Telephone Company is making preparations to place underground its wires in the business section of Greensboro.

CASSELTOWN, N. D.—The Northwestern Telephone Company is expected to extend its lines from Jamestown to Bismarck.

MAYVILLE, N. D.—The Red River Valley Telephone Company has purchased the C. L. Grandin Mayville Telephone Exchange for $6000. Farmers and Mayville business men subscribed for stock to raise the sum. The consolidation of the Mayville exchange with the Valley line gives the subscribers free telephone service and communication all over Traill and the adjoining counties.

NEW LYME, OHIO.—The New Lyme Telephone Company has increased its capital stock from $600 to $3000.

NEW CASTLE, OHIO.—The New Castle Telephone Company has increased its capital stock from $3000 to $5000.

PLINY, OHIO.—The Winfield, Buffalo & Gallipolis Telephone Company has been incorporated; capital, $5000.

HAMILTON, OHIO.—All the officers and directors of the Hamilton Home Telephone Company have been re-elected.

CONNEAUT, OHIO.—The Conneaut Telephone Company has 770 telephones connected and applications for more on file.

UPPER SANDUSKY, OHIO.—The Upper Sandusky Telephone Company has increased its capital stock from $30,000 to $40,000.

TOLEDO, OHIO.—The Board of Public Service is taking steps towards placing the electric and telephone wires underground in certain streets.

CLEVELAND, OHIO.—The official circular is out announcing that the Cuyahoga Telephone Company has taken over the Collinwood Home Telephone Company.

WEST JEFFERSON, OHIO.—The Farmers' Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are Hiram Ingalls, James Huggett, Frank B. Biggert, Finis High and D. A. Crowner.

ELYRIA, OHIO.—At the annual meeting of the Elyria Home Telephone Company, the following directors were elected: E. E. Williams, W. E. Brooks, Jas. A. Drake, S. B. Rawson, F. H. Sudro, W. R. Huntington and David Faxon.

URBANA, OHIO.—The Urbana Telephone Company has held its annual meeting. The directors elected officers as follows: President, C. H. Marvin; vice-president, J. I. Blose; secretary, J. F. Brand; treasurer, John C. Powers; general manager, R. H. Murphey.

EAST PALESTINE, OHIO.—The Salem Township Rural Telephone Company has connected up with the Leetonia exchange of the Columbiana County Telephone Company. H. A. Halverstadt is president and manager of the company and Lester Redfoot is secretary.

CINCINNATI, OHIO.—The stockholders of the Cincinnati & Suburban Bell Telephone Company will, at the annual meeting which takes place on Feb. 15, vote to increase the capital stock of the company probably about $500,000. Conduit extensions are contemplated.

GRATIOT, OHIO.—At the recent annual meeting of the Gratiot & Brownsville Telephone Company, the board organized by appointing S. E. Porter, president; George G. Ardray, vice-president; C. C. Zartman, secretary and general manager, and George D. Orr, treasurer.

BREMEN, OHIO.—The Bremen Telephone Company has been incorporated with a capital stock of $5000. The incorporators are H. M. Shelhamer, A. F. Turney, S. E. Shull, J. C. Shaw, G. E. Turner, M. E. Osborne, J. C. Sherlock, J. S. Brown, J. H. Leonard and W. S. Turner.

AKRON, OHIO.—The Akron People's Telephone Company at its annual meeting reported an excellent year's business, and the following-named officers were elected: President, W. Christy; vice-president, C. W. DeVoe; secretary, J. S. Brenner; treasurer and general manager, W. F. Laubach.

DELAWARE, OHIO.—At the annual meeting of the Citizens' Telephone Company the capital stock was increased from $100,000 to $125,000, and the following-named officers elected: President, W. M. Heseltine; vice-president, W. G. Hormell; secretary and general manager, G. H. Carter, and treasurer, F. P. Hills.

COLUMBUS, OHIO.—The stockholders of Ohio independent telephone companies will meet in Columbus, March 3, when important resolutions which may affect the entire present system, will be presented. At a recent meeting in Columbus of representatives of independent telephone companies every phase of the difficulties which have been encountered by the independent lines was considered.

JUNCTION CITY, OHIO.—The Rush Creek Telephone Company has been recently granted incorporation papers and will operate a line out of Junction City among the farmers and residences in almost every direction. The officers are: W. H. Petty, president; W. S. Tuttle, general manager; W. H. Klingler, secretary; D. S. McCann, treasurer. The company is putting in a metallic circuit. Arrangements have been made with the Bell Telephone Company for long distance service.

TOLEDO, OHIO.—The Northern Ohio Telephone Company has been incorporated with a capital stock of $100,000. The incorporators are G. B. Mouen, Henry N. Perrin, D. H. Perrin, H. C. Kreps and J. M. Ormond. The purpose of the company is to take over the telephone plants at Maumee and Whitehouse, which are now controlled by the incorporators. They will also operate a number of toll lines in and around Maumee.

WARREN, OHIO.—The Warren & Niles Telephone Company is in a very prosperous condition, according to the reports made at the annual meeting. A dividend was declared and it was reported that many improvements had been made in the system and considerable cable put up. The board of directors organized by electing W. Hyde, president; J. Vautrot, vice-president; J. J. M'Clean, secretary and treasurer, and E. G. Miller, manager.

BEAUFORT, S. C.—The People's Telephone Company is constructing a line from here to Yemassee. Mr. R. A. Long, president of the company, expects to build from Yemassee toward Savannah in the near future, and hopes to induce the Savannah Exchange to meet him half way, and connect the two lines.

LETCHER, S. D.—The Storla Telephone Company will build to Mt. Vernon and Lane.

SPRING GROVE, S. D.—The Spring Grove Telephone Company will extend its lines to Summitt in the near future.

WESSINGTON SPRINGS, S. D.—The local telephone company has decided to put in a line to Templeton early next spring.

WOONSOCKET, S. D.—The Farnsworth & Cornell Telephone Company will consider extending the line to Forestburg and a new wire to Woonsocket. J. F. Briggs is secretary.

SCOTLAND, S. D.—At the annual meeting of the stockholders of the Scotland-Wittenberg Telephone Company the following officers were elected for the coming year: President, C. E. Carey; secretary-treasurer, F. L. Wheeler.

EGAN, S. D.—George W. Hart, proprietor of the Egan and Flandreau telephone exchanges and of rural lines running from each place, has sold his property to C. B. Miller, of Egan, and John Miller, of Flandreau, for $12,000.

CAMDEN, TENN.—The Mayor and Board of Aldermen of Camden have passed an ordinance granting the Cumberland Telegraph & Telephone Company a franchise to operate a telephone system in this place. The Cumberland Company has purchased the city exchange.

DECATUR, TENN.—The Morgan County Telephone Company at Decatur has completed its long distance line to Hillsboro, 13 miles from that city. It has to build only to Tuscumbia, about 45 miles where it will connect with the independent company from Memphis. When this link is completed Decatur will have long distance connection with all of the northern States, through both this company's and the Bell systems.

MILWAUKEE, WIS.—The Lone Rock Telephone Company, which was organized last December, will build a line to Richland Centre.

MILTON, WIS.—At the annual meeting of the Milton and Milton Junction Telephone Company held at Milton Junction the present officers were all re-elected.

WENATCHEE, WASH.—The Farmers' Telephone & Telegraph Company will increase its capital from $10,000 to $50,000. Extensions and improvements to the lines will be made.

OTTAWA, ONT.—The Manitoba Legislature has denied the applications for incorporation of the Northwest and the independent telephone companies. In this matter Hon. Robert Rogers stated that there could be nothing to prevent the government from undertaking the ownership and operation of a telephone system of its own. The ministry would accept the responsibility, and during the year would make a close examination of the advantages of a government-owned telephone system throughout the province.

Electric Light and Power.

MOBILE, ALA.—The gross earnings of the Mobile Light & Railroad Company, of Mobile, for the year 1904 were $427,008.48, an increase of $74,141.67 over 1903, or 21 per cent.

ALAMEDA, CAL.—The Chas. C. Moore Company, of San Francisco, has secured the contract to supply to the municipal electric light plant in this city a new alternator and engine. The engine will be a Harrisburg crank tandem-compound, and the alternator a National, of 240-kw capacity. The prices were $7719 and $4888 respectively.

SAN FRANCISCO, CAL.—The Nevada Power, Mining & Milling Company, of which T. J. Campbell of Denver is president, is preparing to install an electric transmission plant for the purpose of supplying electric power for Tonopah and Goldfields, Nev. Contracts are to be let shortly for two 750-kw, 3-phase generators. The hydro-electric plant will be installed on Bishop Creek, Cal. The transmission line will be 90 miles in length and 30,000 volts will be carried. C. O. Poole, formerly with the Standard Electric Company, of California, is the consulting engineer, and J. M. Jones, is engineer.

MARYSVILLE, CAL.—Jas. O'Brien, L. H. Mitchell and John E. Ebert, of Marysville, have filed in the office of county recorder a notice of a location claim to 100,000 inches of water of Yuba River, to be diverted at the narrows by means of a dam and conveyed by ditches to the Sicard flat crossing, where the water will be used for generating electric power, and to Honcut Creek for irrigation purposes. All surplus water will be returned to the Yuba River through Dry Creek. The power so generated to be used in Yuba, Butte, Nevada, Placer, Sacramento, Contra Costa, Solano, Marin, Santa Clara, San Mateo, Yolo and Alameda counties.

NORWALK, CONN., has referred to a committee the question of a municipal electric light plant. The present private system is operated by the Connecticut Railway & Lighting Company.

NORWICH, CONN.—The Uncas Power Company, Norwich, Conn., has petitioned the Connecticut Legislature for incorporation, with the purpose of establishing a water power plant to generate electricity for sale in Norwich and New London. The petitioners are G. D. Jackson, E. W. Higgins and C. W. Comstock.

ROME, GA.—The City Council of Rome, Ga., has appointed a committee to draft a bill to be presented to the legislature authorizing the town to build and operate an electric light plant, the outfit to cost about $20,000.

ATLANTA, GA.—O. H. Sheffield, of Atlanta, is in charge of the erection of the power plant on the Savannah River near Elberton, Ga., and has contracted to furnish power to a number of manufacturing plants in Elberton.

SAVANNAH, GA.—It is said that the Savannah Lumber Company proposes to enter the lighting field in this city and will erect a plant. It will not for the present, however, enter into competition for the municipal lighting. Lawrence McNeill, J. J. Cummings and others are said to be behind the enterprise.

SAVANNAH, GA.—The annual meeting of the Savannah Electric Company has been held. The officers of the company, as elected, are George J. Baldwin, of Savannah, president; Henry G. Bradlee, of Boston, vice-president; A. Stuart Pratt, of Boston, treasurer; L. A. Bowers, of Savannah, assistant treasurer; J. Coolidge Coffin, of Boston, second assistant treasurer; A. Minis, of Savannah, secretary; Henry R. Hayes, of Boston, assistant secretary; Stone & Webster, of Boston, general managers.

WAVERLY, KAN.—Burns & McDonnell, of Kansas City, Mo., are the engineers for the construction of water works and an electric light plant here, at a probable cost of $15,000. The question will be voted on February 14.

COFFEYVILLE, KAN.—Sealed proposals in duplicate form will be received at the offices of the Mayor and City Clerk of the City of Coffeyville, Kan., until 6 p. m., Feb. 3, for furnishing all material for complete electric lighting equipment. Plans, specifications and instructions to bidders are on file for examination by prospective bidders at the office of the city clerk of Coffeyville, and W. K. Palmer, consulting engineer, 718 Dwight Building, Kansas City, Mo.

IDAHO FALLS, IDA.—The Idaho Power & Transportation Company incorporated a few weeks ago, contemplates the construction in this city of a 3000-hp electrical plant.

POST FALLS, IDAHO.—Nelson Bennett, of Tacoma, Wash., has secured the contract for building the power plant at Post Falls for the Washington Water Power Company, of Spokane. The contract price is reported to be about $130,000.

BOISE, IDA.—A contract for the entire electrical equipment of its plant near this city has been awarded by the Barber Lumber Company to the Westhouse Electric & Manufacturing Company, the equipment including three 500-kw generators. It is estimated by the management that the plant will be in operation by May of this year, at which time it is expected that the company's big dam will be completed.

JERSEYVILLE, ILL.—The Jerseyville Illuminating Company was incorporated Jan. 26 with a capital stock of $10,000. The incorporators are Owen Ford, of St. Louis, J. C. Shumway and M. A. Shepherd.

DIXON, ILL.—The plant of the Dixon Power & Lighting Company has been purchased by H. C. Higgins, of the Lee County Lighting Company. The transfer includes all the contracts for lighting the city. The price paid was $200,000.

MACKINAW, ILL.—The Mackinaw Electric Light Company has been incorporated with a capital of $8000. Among the incorporators are Walter Porter and C. G. Sparks, of Mackinaw. The equipment for the plant has been purchased. It includes a Fort Wayne alternator.

VIDALIA, LA.—J. W. Wiggins, manager of the Vidalia Light & Water Company, writes that he will start work about February 1 on the construction of water works, electric light and ice plant combined. The probable cost of work is $40,000.

HEMPSTEAD, L. I.—Regardless of the opinion that has been handed down by Frank Brundage, the referee appointed by the Supreme Court, in the case of the Queens Borough Gas & Electric Light Company, against the Highway Commissioners of the town of Hempstead, which has resulted in a victory for the town and restrains the company permanently from erecting its poles within the limits of the town of Hempstead, ten of the employees of the company have brought suits against the Highway Commissioners, separately and as members of the Town Board in the sum of $10,000 each, which aggregates $100,000.

LOWELL, MASS.—The earnings of the Lowell Electric Light Company for the last month reported show an increase of $2570 in the net earnings.

ADAMS, MASS.—The Hoosac Valley Street Railway Company is installing a 2000-hp power addition to the power station machinery at Zylonite.

WORCESTER, MASS.—The Worcester Electric Light Company is in the market for a battery of 12 boilers of an aggregate capacity of 3000 horse-power.

MILFORD, MASS.—The Milford & Uxbridge Street Railway Company has equipped its power plant with a new 150-hp boiler, thereby materially increasing the facilities of the road.

HOULTON, ME.—The Houlton Electric Light & Power Company has been organized at Houlton for electric lighting. Capital stock, $10,000. President, H. T. Frisbie; treasurer, W. P. Mansur, both of Houlton, Me.

HAVERHILL, MASS.—The Haverhill Electric Company has petitioned the Gas and Electric Light Commissioners for authority to issue $200,000 of new stock for the purpose of enlarging its plant. This will make the total stock $353,000.

DETROIT, MICH.—The Detroit Edison Company proposes to duplicate its present plant next year if the present business keeps up.

BATTLE CREEK, MICH.—This city has given the Kalamazoo Valley Electric Company a franchise for lighting and heating the city. It is reported to be the intention of the Kalamazoo Company to absorb the Battle Creek Electric Light Company and secure its water power.

JACKSON, MICH.—There is talk of merging the electric companies of southern Michigan into the Commonwealth Company. The present water power will be doubled, and an electric power plant, to cost about $100,000, will probably be constructed in Jackson. W. A. Foster, of Jackson, president of the Jackson Light & Power Company, is interested.

BATTLE CREEK, MICH.—Several weeks ago the Kalamazoo Valley Electric Company submitted an ordinance to the Common Council asking for the right to erect and maintain poles and wires conducting electricity for light, heat and power purposes in the city of Battle Creek. This is the company owning the big dam and water power at Allegan, which supplies electric power to Kalamazoo, Battle Creek, Marshall, Albion and Jackson. The present franchise gives the company a right to all of the streets of the city, which is rather sweeping. The old franchise referred only to the furnishing of power and the new franchise gives them the right to furnish electricity for both lighting and heating, which means that something else is to come. After a careful consideration the franchise was granted.

STEAMBOAT SPRINGS, NEV.—The J. W. Hopkins Company will establish an electric power plant in this city, the power to be used in the Great Western mines.

RENO, NEV.—The Truckee River General Electric Company is planning the construction of a power plant, with a capacity of 2000 horse-power, on the river at Marmol, from which electrical power will be delivered to this city, Carson and Virginia City.

GOVERNOR'S ISLAND, N. Y.—Bids are wanted February 15 for installing electric fixtures in four sets of officers' quarters here. Address Traber Norman, Quartermaster.

WEST POINT, N. Y.—Bids will be received by the Quartermaster, U. S. M. A., West Point, on February 15, for the construction and installation of Corliss engines for electric lighting.

PALMYRA, N. Y.—The Palmyra Gas & Electric Company has been incorporated with a capital stock of $25,000. The directors are Carleton C. M. Hunt, Palmyra; Charles A. Schwarm, Hornellsville, and George S. Sheppard, Penn Yan.

SANDY HILL, N. Y.—The Hudson River Electric Company, of Glens Falls, N. Y., has acquired possession of the United Gas & Electric Light Company, of Sandy Hill, N. Y., which has been active in the development of electric lighting in the villages of South Glens Falls, Sandy Hill and Fort Edward.

ALBANY, N. Y.—The Batavia Light & Power Company has filed articles of incorporation. The company is formed to operate franchises and take over the property of the Consolidated Gas & Electric Company. Its capital is $100,000 and the directors are as follows: L. W. Warren, George R. Howard, Porter Norton and E. O. McNair, of Buffalo, and Barber E. Conable, of Warsaw.

BUFFALO, N. Y.—The Iroquois Electric Company, of Buffalo, has been incorporated at Albany with a capital of $1,000,000 to manufacture electricity for light, heat and power purposes in North Tonawanda, Buffalo, Tonawanda and villages and towns in Erie and Niagara counties. The directors are Gen. Francis V. Greene, Edmund Hayes, William H. Hotchkiss, George K. Birge, William H. Gratwick, R. K. Albright, and Stephen M. Clement, of Buffalo.

STATESVILLE, N. C.—The town of Statesville is agitating the question of a bond issue to include $10,000 for electric lights. J. C. Steel is interested.

SANFORD, N. C.—D. E. McIver, commissioner, will on Feb. 4, sell the electric light plant at Sanford, the property of the late A. F. Spencer, including lighting franchises, etc.

ASHEVILLE, N. C.—City Attorney Bourne, of Asheville, is at work upon amendments to the city charter looking to municipal ownership of the electric light plant. The city now spends $7500 annually for 112 arc lights.

NEWARK, OHIO.—The Newark Heat & Light Company has increased its capital stock from $1000 to $200,000, of which $100,000 is to be preferred stock.

SPRINGFIELD, OHIO.—The People's Heat, Light & Power Company has been organized, with a capital of $1,500,000, by John L. Zimmerman, Frank Torrence, Judge F. M. Hagan and others.

HAMILTON, OHIO.—The Hamilton (Ohio) Gas, Light & Coke Company has changed its name to the Hamilton Gas & Electric Company, and increased its capital to $1,000,000. The company will at once spend about $250,000 in improvements and extensions. A new electric plant is to be installed.

HOWARD, PA.—Bids are wanted February 6 for constructing a municipal electric light plant. W. E. Confer, borough secretary.

MONTREAL, QUE.—The Montreal Light, Heat & Power Company, which has just closed with the towns of Verdua and Outremont new contracts for the supply of electric energy, now has exclusive franchises for at least twenty years with all the towns using gas and electricity for lighting purposes on or around the island of Montreal, with the exceptions of Westmount. It is largely the result, it is said, of these exclusive franchises that the company looks to securing a new franchise from the city of Montreal. The basis for nearly all the contracts is the same, allowing the towns to take electric light at $75 per lamp per year upon their agreeing to take the same kind of lamp as now used in Montreal. The company, it is announced, has also closed a long-term contract with the Grand Trunk Railway to supply all the power and light required in that railway company's different shops and buildings.

NARRAGANSETT, R. I.—The Narragansett Electric Lighting Company has been engaged in erecting some new transformers. The company proposes to increase its capital to $1,000,000.

WICKFORD, R. I.—It is understood that the village electric light plant, owned by H. S. Dixon, will probably on February 1 pass into the hands of the Wickford Water & Light Company, which will contract with the Sea View Electric Company to furnish the current for lights from the power house in Hamilton.

CLIFTON, S. C.—The new electric drive for Clifton mills No. 3, at Clifton, where 35,000 spindles and 1000 looms are in operation, has been started up, the power plant having been installed by A. T. Thompson & Co., of Birmingham, Ala.

SPARTANSBURG, S. C.—George E. Ladshaw is installing a power plant for the lighting of the town and furnishing power for a number of industrial concerns. Ladshaw & Ladshaw have been at work for some time on the plant and it is well under way. Three thousand horse-power will be developed on Horse Creek and by hydro-electric transmission will be utilized in Sumter.

JEFFERSON CITY, TENN.—The plant of the Jefferson City Electric Light & Power Company was destroyed by fire.

MEMPHIS, TENN.—Mr. Raine has presented a bill in the Tennessee Senate which proposes to amend the charter of the city of Memphis, permitting it to acquire or construct and operate on municipal account gas and electric lighting plants. The bill also authorizes the putting out of $1,000,000 4 per cent. bonds to run for 30 years.

HUMBOLDT, TENN.—The Board of Public Works, upon which devolves the management of the Humboldt light and water plant, has submitted its report, covering a period of eleven months to January 1. The report shows for the eleven months a net profit of $3,552.05, the installation of new and profit-sharing machinery to the value of $3,255.47 and extension of light and water mains, $2,464.08, making a total of $5,719.55 expended in enlarging and strengthening the plant. The Board's recommendation of enlarged boiler capacity for the future development of the plant was indorsed and the purchase authorized of two new boilers in size fully sufficient to allow of the development of the plant for the next ten years.

SAN ANTONIO, TEX.—C. A. Zilker is reported interested in the construction of an electric light plant here, to cost about $100,000.

ROLSE CITY TEX.—The Royse City Milling & Light Company has been incorporated with a capital of $20,000. J. N. Miller is one of the incorporators.

HUNTSVILLE, UTAH.—The citizens are considering the question of issuing bonds for the construction of a municipal electric light plant.

MANASSAS, VA.—W. E. Crosen & Company, of Leesburg, have petitioned the City Council at Manassas for a franchise for an electric light system. The proposed plant will have a capacity of 750 standard, 16-c-p lamps.

NORFOLK, VA.—It is stated that the R. B. Fentress Company, which has been endeavoring to secure a franchise in Norfolk to erect a lighting and heating plant, will not give up the fight to secure the desired rights but that it will likely make the attempt again along other lines.

SPOKANE, WASH.—The Washington Water Power Company has tested its power line into the Coeur d'Alenes with 70,000 volts. As soon as the transformers can be connected up 60,000 volts will be carried regularly instead of 45,000 as at present. The line transmits electrical energy from the Spokane Falls, 100 miles to the mines. The company has let a contract to Nelson, Bennet & Company and C. S. Bihler, contractors, of Tacoma, Wash., for rock excavation and the building of a power dam in the Spokane River, at Post Falls, Ida. The contract price is for $135,000. The work is to be completed by August 1 and the company will install machinery to develop 18,000 electrical horse-power.

BENWOOD, W. VA.—The Ohio Valley Electric Light Company, of Benwood, has been organized, with Thos. P. Deegen, president, and Wm. Leach, Jr., secretary. It is the intention of the company to increase the old plant by the installation of new and modern machinery and remove the remainder of the McMechen plant to Benwood.

MANITOWOC, WIS.—The City Council has directed the city engineer to prepare estimates on the cost of an electric light plant.

CODY, WYO.—The installation of a power plant in this city is projected, Mr. George T. Beck, of this city, being the chief promoter.

The Electric Railway.

LITTLE ROCK, ARK.—The North Arkansas Electric Railroad & Power Company, of Jasper, has filed a certificate with the Secretary of State providing for the extension of its line from Mount Hersey, up the Buffalo River to its headwaters, thence down the Mulberry and by Ozark to the Arkansas River, thence to Fort Smith, a distance of 140 miles; also that the capital stock be increased from $150,000 to $4,000,000. A. W. Bates was elected chief engineer. S. J. Norman is the principal promoter.

NEW HAVEN, CONN.—The transfer of the Berkshire Street Railway to the New York, New Haven & Hartford Railroad for incorporation into the Consolidated Street Railway which operates the electrical properties of the steam road has been concluded.

ROCK ISLAND, ILL.—The Rock Island, Moline & Davenport Suburban Railway Company has been organized by August E. Steffen, C. G. Hipwell, of Davenport; John W. Green, Stewart Spaulding and William A. Rawson, of Chicago.

SWEETWATER, ILL.—The Springfield, Sweetwater & Peoria Electric Railway Company has been incorporated by George W. Hatch, Greenview, Ill.; Thomas H. Alkire, John W. Terhune, James E. Culver and Augustus K. Jones, of Sweetwater, Ill.

WAUKEGAN, ILL.—The Watseka & Kankakee Traction Railway Company, with principal office in this city, has been incorporated with a capital of $25,000. The incorporators are David Magill, George W. Hoyt, Walter H. Hogan, O. F. Morgan and Robert L. Harrell, of Watseka, Ill.

SPRINGFIELD, ILL.—The Springfield & Western Railway Company has been incorporated with a capital of $100,000. The incorporators and first board of directors are F. M. Mills, D. A. Watson, George A. Wood and R. H. McAnulty, of Springfield, and K. H. Seibel, of Chicago.

EAST ST. LOUIS, ILL.—Articles of incorporation were filed Jan. 9 by the Troy & Suburban Railway Company, with principal offices in East St. Louis. The capital stock was $50,000. The company is to construct a line from Troy to Maryville. The incorporators are L. C. Haynes, J. M. Bramlette and T. W. Gregory, of East St. Louis; M. W. Schaefer and James A. Farmer, of Belleville. The directors and the officers are identical.

PERU, IND.—The Central Electric Traction Railway Company of Indiana has filed articles of incorporation. The capital stock is $25,000. J. O. Cole, Jerome Herff and H. F. Masters are the incorporators.

INDIANAPOLIS, IND.—A bill to create a railroad commission is before the Legislature and is being bitterly opposed by the steam roads. One of the objections is that the bill provides, or rather compels, steam roads to interchange traffic with electric lines.

PORTLAND, IND.—The Indianapolis, Hartford & Celina Traction Company has filed a petition before the County Commissioners for a franchise to construct an interurban railway through the county, touching Pennville. The line is to run from Indianapolis, through Alexandria and Hartford City to Celina, Ohio.

INDIANAPOLIS, IND.—The Indiana Supreme Court has just held that an interurban railroad must observe its contracts with farmers along the right of way. The Indianapolis, Greenwood & Columbus Electric road, in consideration of the right of way, agreed with property owners that cars should stop at certain crossings. In order to make better time, the road cut out many of these stops, and the farmers sued to enforce the agreement, and the court says the company must stop its cars at places agreed upon.

MARSHALLTOWN, IA.—At a meeting of the stockholders of the Marshalltown Electric Street & Interurban Railway Company it was announced that the project had been financed and that the road would be built during the present year, from Marshalltown to Grundy Center, Ia. The directors elected the following officers: A. G. Glick, president; L. C. Norris, vice-president; C. R. Speers, secretary; all residents of Marshalltown.

ARKANSAS CITY, KAN.—At the annual meeting of stockholders of the Kansas-Oklahoma Interurban Railway, Jan. 10, the former board of directors was re-elected. The following officers were elected: W. C. Robinson, of Winfield, president; L. H. Northrup, of Arkansas City, vice-president and general manager; S. P. Gould, auditor; C. A. Scruton, treasurer. The company announced that work would begin at once.

NORTHAMPTON, MASS.—The Northampton Traction Company held its annual meeting in this city when the following officers were elected for the ensuing year: President, Thomas A. H. Hay; vice-president, Harry H. Haines; treasurer, Chester Snyder; secretary, William O. Hay; superintendent, D. L. Beauleau.

SOUTH HAVEN, MICH.—A new franchise for an electric railway has been granted to C. W. Williams, of South Haven; George Bardeen, of Otsego, and S. J. Dunkley, of Kalamazoo. The new corporation must have cars running by July to hold the franchise. Extensions will be made to Kalamazoo and Saugatuck, which will give South Haven a direct line with Detroit and Grand Rapids.

GLENDIVE, MONT.—The Commissioners of Dawson County have granted a franchise to H. J. Haskell, E. S. Baer, B. S. Adams, J. J. O'Brien and J. R. Widwyer, petitioners for the Glendive & Yellowstone Valley Rapid Transit Company, to build an electric railway and telephone line from Glendive to a point on the Missouri River opposite Buford, N. D., a distance of 80 miles. The road will traverse the entire length of the lower Yellowstone Valley, in which the Government will begin the construction of irrigation work in the spring, which will cost approximately $3,000,000, and reclaim 60,000 acres of land.

LINCOLN, NEB.—Business men of Lincoln have completed the organization of the Citizens' Railway Company, and will compete with the Lincoln Traction Company. The capital stock is $1,000,000, and $53,000 was paid in.

Among the stockholders are Alex. Berger, F. W. Levering, C. G. Crittenden, Louis E. Wettling, L. P. Funkhouser, J. E. Miller, W. E. Sharpe, J. H. Smith, E. J. Hainer, A. O. Faulkner, F. W. Brown, L. A. Ricketts, Hall & Woods, T. P. Kennard, W. T. Fitzgerald, C. O. Wheedon, Mark Woods.

MANCHESTER, N. H.—The Derry & Manchester Railway has been organized by George H. Chandler, Harry E. Parker and Roswell Annis, all of Manchester; David F. Perkins, of Londonderry; Edwin N. Whitney and C. N. Greenough, of Derry. The capital stock shall not exceed $100,000.

CAMDEN, N. J.—The North Atlantic City Railroad Company has been incorporated with a capital stock of $210,000. The incorporators are John O. Heald, Robt. J. Wright, Geo. A. Aldrich, Joseph R. Gillam, Wm. Hammersley, Walter S. Aldrich, Edwin G. C. Bleakley and Henry F. Stockwell.

CORTLAND, N. Y.—The Cortland County Traction Company is making preparations for the extension of its lines to Little York. The addition to the power house will be completed soon, and the company will have ample power to operate the new line.

NEW YORK, N. Y.—The subway has been placed in operation as far as Fulton Street for express trains only. This is very convenient for those working below Fulton Street who use the subway regularly, as it saves their walking to City Hall Park, five or six blocks distant.

CANAJOHARIE, N. Y.—New York parties have made propositions to the members of the Board of Trade of Canajoharie to build and operate an electric railway between that place and Milford. The business men along the proposed route will appoint a committee to consider the propositions.

ALBANY, N. Y.—The New York & Ottawa Railway Company has been incorporated to reorganize the electric railway from Tupper Lake through the Adirondacks to St. Lawrence River. The capital stock of the company is $1,250,000, and the directors are William K. Vanderbilt, J. Pierpont Morgan, H. McK. Twombly and William Rockefeller, of New York.

SPRINGFIELD, OHIO.—The Springfield Railway Company is planning to build 2 miles of new line next spring, being extensions of the West Pleasant Street line and the Columbus Avenue line.

SPRINGFIELD, OHIO.—The Springfield, Troy & Piqua Traction Company has completed surveys for a branch line to St. Paris, and this will probably be built next summer. It is the intention to extend either to Piqua or to Sidney.

LIMA, OHIO.—The Lima, Findlay & Toledo Railway Company has been incorporated with a capital stock of $700,000. The names of the incorporators are Frank Butler, E. Sanburn, Jas. H. Griswold, Chas. L. Stocker and N. S. Harris.

COLUMBUS, OHIO.—The Bucyrus, Sulphur Springs & New Washington Traction Company has been incorporated, with $10,000 capital stock, by Ellis Bartholomew, W. E. Mosier, S. S. Thorn, F. W. Armbruster and Elmer Luke. The same people are interested in the Marion & Bucyrus Railway.

YORK, PA.—The Chambersburg, Greencastle & Waynesboro Electric Railway Company will extend its line from Pen-Mar to Gettysburg.

SCRANTON, PA.—It is reported that the Erie Railroad Company will purchase the Dunmore branch of the Lackawanna & Wyoming Valley Electric Railway Company.

EASTON, PA.—The following directors were elected by the stockholders of the Easton & Belvidere Street Railway Company; C. L. Hemingway, Howard Mutchler, Charles A. Laros, John H. McGrath and John H. Blair.

BELLEFONTE, PA.—The Bellefonte Traction Company has been chartered at Harrisburg by J. C. Meyer, John Olemire, J. W. Conley, Robert Hunter, C. Price and Lewis Reber. The company will build a line from Milesburg through Belefonte, to Pennsylvania State College.

DELAWARE, PA.—At the annual meeting of the stockholders of the Delaware Street Railway Company, Warren A. Wilbur, J. Davis Brodhead, Howard Mutchler, Charles A. Laros and John H. McGrath were elected directors, who in turn elected Warren A. Wilbur, president; John H. McGrath, secretary, and J. Davis Brodhead, treasurer.

ALLEGHENY, PA.—Two ordinances for traction lines in Allegheny have been introduced in Allegheny Select Council. Numerous streets are sought by the Marshall Avenue Street Railway and the Washington Street Railway Company, whose original length of seven and one-half miles has been extended many times by loops and links reaching every section of the Northside.

POTTSVILLE, PA.—The stockholders of the seven allied corporations of the Pottsville Union Traction Company have elected a board of directors composed wholly of Philadelphians. C. P. King was chosen president; Thomas B. Prosser, vice-president, and William C. Pollock, Jr., secretary. It has been decided to build extensions from St. Clair to Frackville and Shenandoah, and from Middleport to Tamaqua in the spring.

WILKESBARRE, PA.—The motormen and conductors in the employ of the Wilkesbarre & Wyoming Valley Traction Company have voted to go on strike. The men want an increase from $1.80 to $2 a day. No date is set for the beginning of the strike. Before the final step is taken, another attempt will be made to effect a compromise with the company. The company officers say they will not concede the demands of the employees.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company has decided against issuing 6 tickets for 25 cents, about which there was considerable discussion, because of the peculiar transfer arrangements of the company which now make the fare practically 4 cents flat. What are known as exchange tickets are now sold by the company for 8 cents. These are secured on the cars, and are good for passage whenever presented. One transfer is issued on them. A single fare is 5 cents. Six tickets for 25 cents would mean a fare of 4¼ cents.

PROVIDENCE, R. I.—On Jan. 20, Senator Young, of Scituate, introduced in the Senate an act requiring all street railways to provide vestibules for motormen in cold weather. The act was read and referred to the committee on special legislation.

SUMPTER, S. C.—The Sumpter Electric Light & Railway Company has been incorporated with a capital of $200,000. E. M. Beale, of Lewisburg, and J. L. Almett and H. F. Wilson, of Sumpter.

CHATTANOOGA, TENN.—Steps have been taken by those interested in the Cleveland-Ducktown Interurban Railway to make the preliminary survey for the proposed line from the Chickamauga Park line of the Rapid Transit Company, at the army post, to Ringgold, Ga., and thence to Catoosa Springs. The company is to be incorporated with a capital of $300,000, which will be increased to $2,000,000. Geo. C. Cushman, of Chattanooga, and M. R. Tremier, of Ringgold, have been selected to make the survey.

OTTAWA, ONT.—The Canadian Pacific Railway Company has decided on the installation of its own power plant to supply all the power and electric lighting in all its new shops. Its electrical experts have reported that the power could be obtained at less cost than if purchased from any local power concern. On the other hand the Grand Trunk experts found that power could be got cheaper from such concerns.

New Industrial Companies.

THE HAYES ELECTRIC COMPANY has been organized at Aurora, Ill., with a capital of $3000. Thomas J. Hayes, Emery R. Price and Frank Lauser are the incorporators.

THE GILLEN ELECTRIC COMPANY has been incorporated at Columbus, Ohio, by E. J. Gillen, S. H. Gillen, D. F. Streb, W. S. Rowell, A. L. Vermilye; capital, $10,000.

THE GENERAL INSULATION & MACHINE COMPANY, of Brooklyn, N. Y., has been incorporated with a capital stock of $50,000. The directors are Levi Swanson, Joseph Steinberger and A. L. Hart, Brooklyn.

THE ROME ELECTRICAL COMPANY, of Rome, N. Y., has been incorporaed with a capital stock of $40,000. The directors are N. H. Jones, G. A. Clyde, W. R. Huntington and W. W. Parry, Rome.

THE FEDERAL RAILWAY SIGNAL COMPANY, Jersey City, N. J., has been incorporated with a capital stock of $2,000,000. The incorporators are Richard C. Fessenden, James F. Reed and John F. Gough.

THE SELLS, MILLER, SANTE COMPANY, Rockford, Ill., has been organized to deal in electric sundries. J. Frank Sells, Harry J. Miller and Charles F. Sante are the incorporators of the new company.

THE DENIO GENERAL ELECTRIC COMPANY, of Rochester, N. Y., has been incorporated with a capital stock of $250,000. The directors of the company are H. F. Atkinson, G. W. Ham and W. L. Denio, Rochester.

THE CONNECTICUT DYNAMO & MOTOR COMPANY, of New York City, has been incorporated with a capital stock of $17,000. The directors are Donald McDonald, H. J. Brewer and J. P. Munn, M. D., New York.

THE ELECTRIC SUPPLY COMPANY, Massillon, Ohio, has been incorporated with a capital stock of $10,000. The incorporators are F. F. Flickinger, R. S. Hardgrove, E. F. Heisler, Gust Rhine and J. A. McLaughlin.

THE AUTOMATIC ELECTRIC TIME SWITCH COMPANY, of Derby, Conn., has been formed; capital paid in, $1000. Incorporators: Clifton E. Hoyt, of Derby; Eli M. Rogers, of New Haven; Clark L. Hoyt and Albert W. Piper, both of Derby.

THE MILLER MOTOR CAR & SUPPLY COMPANY, of Bridgeport, Conn., has been incorporated to deal in motor vehicles and supplies. Capital paid in, $2000. Incorporators: Wallard R. Miller, Alma E. Miller, Edward M. Wells, all of Stratford.

Legal.

INJURY TO TELEPHONE LINEMAN.—The Supreme Court of Iowa has affirmed a verdict for damages in the suit of Barto vs. the Iowa Telephone Company on the following grounds: 1. A telephone company which allows an electric light company to string wires on its poles must use reasonable precautions to see that the electric light wires do not expose its employes to unusual peril. 2. Persons maintaining and using electric apparatus must use a degree of care and skill commensurate with the danger involved. 3. In an action by a telephone lineman against his employer for injuries caused by coming in contact with defectively insulated electric light wires which defendant allowed the electric light company to string on its poles, evidence held to justify submission to the jury of the issue of defendant's negligence. 4. Where a telephone lineman not required to inspect the wires for defects nor furnished with tools for testing live wires was injured by touching a telephone wire which had become charged by contact with a defectively insulated electric light wire, he was not chargeable with knowledge of the condition of the wire, and hence did not assume the risk. 5. In an action by a telephone lineman against his employer for injuries caused by coming in contact with defectively insulated electric light wires which defendant allowed the electric light company to string on its poles, evidence held to justify submission to the jury of the issue of plaintiff's contributory negligence.

FATALITY FROM SHOCK.—Judgment for the defendant has been affirmed by the Supreme Court of Illinois in the case of Home vs. Taylorville Electric Company, the points at issue being summed up as follows: 1. A telephone employe fell from a pole on which he was at work on receiving a shock from a current of electricity, caused by the wire which he was handling coming in contact with a live wire of an electric company. His neck was broken by the fall, but if he had used a safety strap, with which he was supplied, to fasten himself to the pole, he would not have fallen. Held that, if the shock

was sufficient to kill him, it was immaterial whether he fell or not, and that the court would not have been justified in directing a verdict on the ground that he was negligent in that respect. 2. While the duty of an electric company to maintain perfect insulation does not extend to its entire system, it extends to wires strung 25 feet above ground in a street where telephone employes are likely to come in contact therewith while attending to their duties. 3. Where the wires of an electric company were not properly insulated, and an employe of a telephone company was killed by the turning on of the current without the warning which the electric company was accustomed to give its own employes who were at work about its wires, it was not liable for his death, in the absence of evidence of an agreement between the companies as to signals, or any knowledge on the part of the electric company that the telephone men were relying thereon.

NO TELEPHONE COMPETITION IN CINCINNATI.—The Circuit Court at Cincinnati recently delivered an opinion in the suit of the Queen City Telephone Company against the city, involving the right of the company to construct and maintain telephone wires in conduits in the streets of Cincinnati. The opinion is against the company. The Court says that in any event the company had no right to construct and maintain underground wires and conduits. This, because, as the Court interprets the law, the statute requires that the company that desires to construct and maintain underground wires and conduits must be one which owns and operates a telephone exchange or is doing a telegraph business in any city in this State and has obtained the consent of the municipality in which it is desirous of constructing such lines. It is declared by the Court that there is no authority given by the law to any other sort of company to so construct such lines. As it was admitted that the Queen City Company was not and is not operating a telephone exchange in this city, nor was it doing a telegraph business, it has no right to construct and maintain underground wires and conduits in Cincinnati. And, besides, it is held that if it had been doing such business it would be necessary to get the consent of the city authorities to lay the wires. As such consent was refused by the city, the company was excluded. The net result of this decision is that at present the telephone company that is now operating in the city has alone the right to do a telephone business there, and the independent companies are shut out; that until such independent companies find, first, a means of establishing and operating an exchange in the city, and, second, then obtain the consent of the city authorities, they cannot invade this field with their lines; and the present operating company is left with a monopoly of the business.

CITY LIGHTING CONTRACT.—In the suit of Kennedy vs. the City of New York, the appellate Division of the Supreme Court, second department, has sustained the verdict for plaintiff and the order denying a new trial. The suit related to lighting in Long Island City. The main points were as follows: 1. In an action against a city on a lighting contract, in which the defense was that the contract was void because when made there was in existence a contract by the city with another lighting company, to which the total appropriation for lighting was legally applied, evidence examined, and held not to establish the existence of such other contract, so as to render a verdict based on a contrary conclusion erroneous. 2. In an action against a city for furnishing lights under a contract duly executed, the city cannot escape payment on the plea that there was a prior existing contract under which the common council had appropriated all of the taxes laid for lighting purposes, when it appeared that such appropriation was not compulsory by the terms of the former contract, but was an arbitrary act of the city in disregard of the obligations of the second contract. 3. Though a contract to furnish lights to a city required lights from sunset to sunrise, a failure to perform, forfeiting right of recovery thereunder, was not shown by evidence that lights were not always so furnished, in view of another provision for a rebate pro rata according to the time that lights were not lighted during any of the time therein provided. 4. Where, in an action on a contract for furnishing lights to a city, it did not appear that the city had ever complained that a failure to furnish lights within certain hours was not within a provision of the contract permitting a rebate pro rata according to the time lights were not so furnished, the city was estopped to deny that there was a failure to perform, forfeiting recovery under the contract.

DEATH FROM OVERLOADED TRANSFORMER.—In the suit of Reynolds vs. Narragansett Electric Lighting Company, the Supreme Court of Rhode Island, in granting defendant's petition for assessment of damages, made various points some of which are here cited. The case was one where death resulted from contact with an apparently overloaded transformer: 1. The breaking of an electrical apparatus under the control of defendant, resulting in an excessive current being received into the lighting system of a building, causing plaintiff's death, is inferentially evidence of negligence, casting on defendant the burden of rebutting it. 2. Where death results from the breaking of an electrical transformer, the presumption of negligence is not met by proof that it was made by a reputable manufacturer, without a showing as to who purchased it, when it was purchased, how long it had been in service, its condition at installation, and when it was inspected. 3. Where death was caused by transmitting an excessive voltage into the lighting system of a building resulting from the breaking of defendant's transformer, it was not error to instruct that defendant was not responsible for any accident occurring from defects in the interior wiring if it was not done by defendant, and it had no control over it, unless it was negligent in the outside wiring, or in its connection with the inside wiring. 5. Where death resulted from the breaking of defendant's transformer, admitting an excessive voltage into the lighting system of a building, a requested instruction that it would not be negligence for defendant to omit the grounding of the secondary wires, if it was not permitted to do so, was properly refused, as being too broad. 7. A requested instruction that defendant had the right to assume that the interior wiring was properly done, and that the lamps in the cellar were arranged in a manner that would insure the greatest safety, was properly refused. 8. A special question to the jury: "At the time of the accident, was the opinion of a great majority of the best experts that it was desirable to ground secondary wires, as a means of safety to life?" answered in the affirmative, was not objectionable because grammatically bad.

Personal.

PROF. REGINALD A. FESSENDEN has been appointed to the municipal power commission of the Province of Ontario, Canada.

MR. THOMAS FERRIS, Milwaukee representative of the General Electric Company, has resigned to take the management of the Osage (Ia.) Electric Light, Heat & Power Company in which he has acquired an interest.

MR. EDWARD VAN WINKLE will continue the engineering business formerly carried on in New York City by himself and Mr. Chas. R. Pratt. Mr. Pratt has retired in order to devote his entire time in the interst of the safety elevator company which bears his name.

DR. CARY T. HUTCHINSON has advised Mayor McClellan, of New York, that the larger plans for the municipal lighting of New York will cost $100,000 and the smaller $25,000. His own fee for the work would be $5000. The plans could not be ready before next summer.

MR. G. R. HEISEY, of Lancaster, Pa., recently purchased the Red Lion central station. The capacity of the plant will be doubled and the lines extended to Dallastown, Yoe and Windsor. Mr. Ray H. Nessly, of Lancaster, is engineer of the new company.

MR. R. T. LOZIER, of the National Electric Company, of Milwaukee, Wis., is visiting the East on important business, and has assisted in closing some large contracts. He reports that the new Lundell motors have enjoyed a most flattering welcome, and that the results in operation are admirable.

MR. C. L. EIDLITZ.—With respect to the suit which the Brotherhood of Carpenters has begun against Charles L. Eidlitz, as president of the Employers' Association, for $250,000 damages because of the lockout, Mr. Eidlitz is quoted as saying: "I do not expect for a moment that the carpenters will get a verdict, but if they do it will be the end of organized labor."

MR. W. H. AYMAR, who for a long time past has acted as cashier of the C. & C. Electric Company, 143 Liberty Street, New York City, has been appointed secretary of the concern, vice Mr. Campbell Scott, resigned. Mr. Scott who, it will be recalled, was also general manager of the company, has been succeeded in that capacity by Mr. W. B. Elliott, formerly works manager.

PROF. F. A. FISH, of the Ohio State University, has been elected by the trustees of the Iowa State College, Ames, Ia., to succeed the late Prof. B. S. Lanphear in the Electrical Engineering Department. Prof. Fish was educated in the University of Ohio and the University of Wisconsin and has been engaged for a number of years in electrical work. He is joint author with Prof. Caldwell of a textbook on laboratory methods.

MR. JOHN CRAIG HAMMOND, a well-known Western journalist, who is handling the campaign of publicity for the Denver Convention of the National Electric Light Association, has been visiting the East in the interests of the meeting, and has been spending several days in New York. No doubt remains in his mind or that of Mr. H. L. Doherty as to the great success of the convention, with a record-breaking attendance.

MAJOR M. GRAY ZALINSKI has been appointed to take charge of the new construction which has been authorized to transform old Fort Omaha, at the north of Omaha, Neb., into a signal service school or station of the U. S. Army. A partial appropriation has already been made for the necessary equipment. The fort has been practically abandoned for a number of years since the erection and transfer to the new Fort Crook near Albright, just south of South Omaha.

MR. R. B. WILLIAMSON, who for the past five years and a half, has had charge of the electrical engineering department of the International Correspondence Schools, Scranton, Pa., has resigned to accept a position on the engineering staff of the Bullock Electric Manufacturing Company. Mr. Williamson will be located at Cincinnati and will enter upon his new duties about the middle of February. He is a graduate of Cornell; was in the employ of the Canadian General Electric Company, and later was instructor at Lehigh University, leaving there to enter the employ of the Scranton schools.

MR. WM. H. BLOOD, JR., has the chairmanship of the committee on district heating for the National Electric Light Association, and expects to present a very full and important report on this branch of central-station industry. The other members of this committee are Mr. C. R. Maunsell, of Topeka, Kan., and Mr. R. S. Wallace, of Peoria, Ill., both of whom have had personal experience with steam and hot-water heating plants, as well as having given the subject extensive study and observation. A liberal appropriation has been made by the association for carrying on investigations, and the work will be very thoroughly done.

MR. J. K. ROBINSON, of Iquique, Chili, is now in New York on an important buying mission. He represents the interests of the Westinghouse Electric & Manufacturing Company, Westinghouse, Church, Kerr & Company, the Westinghouse Machine Company, the Standard Underground Cable Company, the Sawyer-Mann Electric Company, R. D. Wood & Company and the Goulds Manufacturing Company throughout Chili, Boliva, Peru and Ecuador. Mr. Robinson will sail for England in a week or two. While here he is making his headquarters at the offices of William E. Peck & Company, 116 Broad Street.

MR. E. C. BENEDICT and party have just returned to New York from a trip up the Amazon in his steam yacht *Virginia*. During the trip, two Fessenden wireless telegraph stations were established, one at Para and one 140 miles further up the great river. They will be usd for commercial purposes and are badly needed.

MR. S. P. SHEERIN, the well-known independent telephone leader of Indiana and president of the independent exchange system in Indianapolis, has been visiting New York, and has been interviewed by the *New York Herald* to show what an opposition system can do. It is said that the *Herald*, in its fight on the New York Telephone Company, is back of a scheme for a new telephone company, as it was once of the Mackay-Bennett cable, out of which it made a very handsome profit. Mr. Sheerin claims that the New

York Bell business makes profits offsetting the losses in the Western States where the rates, like those of the opposition independents, are too low. Mr. Sheerin noted the wonderful development in farmer line telephony seen of late years in Indiana.

MR. CHARLES H. BAKER, who founded the Snoqualmie Falls Power Company, of Seattle and Tacoma, and who since its beginning, six years ago, has been the active president and chief engineer thereof, and who also as manager and chief engineer has promoted and planned the White River Power Company, has sold a controlling interest in both companies to a party of capitalists who have elected as president N. H- Latimer, manager of the Dexter Horton Bank of Seattle. Mr. Baker is planning an early trip to Japan and China for pleasure and rest, and for the purpose of exploring the water power and electrical possibilities of these countries. The capacity of the Snoqualmie Falls plant as built by Mr. Baker is 19,000 horse-power and of White River, 50,000 horse power.

GEN. F. V. GREENE, president of the Ontario Power Company, gave a very interesting lecture recently at the Perkins' Memorial Hall, Buffalo, N. Y., on the electrical development of Niagara Falls. One remark he made was as follows: "There has been some feeling that not in the slightest respect should the natural beauty of the Falls be affected. As usual, with such extremes, a middle course has been followed. When the several projects now under construction are finished about a fifth of the water will be diverted from passing over the Falls. It is probable that the appearance of the Falls will be changed when the 640,000 horse power now planned are developed, especially the American fall, which carries only a small part of the total volume. A diverting wall could be built from the head of Goat Island toward the international boundary line, thus sending toward the American fall enough water to keep up its present appearance."

MR. W. N. STEVENS, who has for some time filled the position of assistant mechanical engineer of the Rapid Transit Subway Construction Company, has accepted a position with J. G. White & Company, New York City. Mr. Stevens has had a wide experience as a constructing engineer in the designing and active construction of important power plants. He had much to do with the design and construction of the Twelfth Street power house of the New York Edison Company. He also has had charge of the design and construction of the mechanical equipment of the Seventy-fourth Street power house, and has lately been engaged on the work of designing and building the Fifty-ninth Street power house, nine transformer stations, car barns, shops and other adjuncts to the construction and equipment of the Rapid Transit Railroad in New York City. During his professional career, Mr. Stevens has also been engaged in engineering undertakings in other parts of this country and abroad, having made both the preliminary and afterwards the final plans for the machinery of the power house for the tramways of Sydney, Australia. J. G. White & Company are to be congratulated in having secured the services of Mr. Stevens in their mechanical engineering department.

MR. ELLIS E. BROWN has resigned his position as electrical engineer of the Philadelphia & Reading Railway Company and Atlantic City Railroad Company, with which roads he has been connected for the past five years, during which time he designed and installed the power station and electrical equipment in connection with the Philadelphia & Reading Railway Company's locomotive repair shops at Reading, Pa.; also the reconstruction of the Cape May, Delaware Bay & Sewell's Point trolley road, together with numerous other electrical installations over the system. Mr. Brown is a graduate of the regular and post graduate courses of the Worcester Polytechnic Institute, from which he received the degrees of B. S., M. S. and E. E. He is an associate member of the American Institute of Electrical Engineers, and has resigned his position, noted above, to accept the managership of the Brown Engineering Company, with offices in Reading, doing business as consulting and contracting engineers, particularly for electric power plants and electric mining plants. The Brown Company has headquarters in Reading at the Second National Bank Building.

MR. CALVERT TOWNLEY.—Thirty former associates of Mr. Calvert Townley, who recently resigned from his duties as general agent of the Westinghouse Electric & Manufacturing Company in New York to act as electrical agent for the New Haven Railroad, entertained Mr. Townley at dinner at the Hotel Astor, New York, on the evening of Friday, January 27. The affair was a very informal one, and the feature of the evening, after a brief complimentary speech by Mr. Charles A. Terry and a response by Mr. Townley, was the very remarkable exhibition of card magic and legerdemain given by Mr. Thomas B. Arnold, the Eastern representative of the Latrobe Steel Company, who is described as a veritable wizard in tricks of this nature. Others present were Messrs. Frank H. Taylor, William F. Zimmermann, F. B. H. Paine, E. W. T. Gray, Newcomb Carlton, T. W. Siemon, Paul T. Brady, Seth C. Adams, W. C. Webster, C. B. Humphrey, Charles F. Scott, F. N. Kollock, Jr., E. St. John, D. C. Manson, F. L. Townsend, W. C. Ward, W. E. Drake, H. F. Jones, George E. Miller, J. M. Curtin, W. L. Conwell, W. S. Rugg, O. T. Smith, C. C. Owens, P. R. Owens, Charles Robbins, H. D. Pritchard, W. H. McGregor, and J. K. Robinson, of Iquique, Chili. Mr. George Westinghouse sent a telegram regretting his inability to be present. Mr. Townley's new title is that of assistant to Charles S. Mellen, president of the Consolidated Railways of New Haven, the electric railway holding corporation of the New York, New Haven & Hartford Railroad Company.

Obituary.

MR. G. S. BOWEN, of Elgin, Ill., the founder of the National Electric Light Association, and one of the foremost early settlers and citizens of Illinois has just died. He was at one time connected with the Van Depoele electric lighting interests and the Star iron tower with which much of the early mast and tower arc lighting was done in the United States and Mexico.

MR. R. W. MORSE, who died December 14, was for 13 years the head of the Shenandoah Electric Light & Power Company, Shenandoah, Ia., until the last year when the company was reorganized to extend the business by adding a heating system. He still retained an interest with the company and was succeeded in office by his son. Lately his health had not been good and a trip to California had been contemplated. He was born in Maine in 1837 and and 37 years ago moved to Illinois, starting as a locomotive engineer. Twenty-five years ago he removed to Shenandoah and for 15 years was engaged in the grain business. He was a Mason of high degree, a public-spirited citizen and a man who by his sterling qualities won a position of influence and esteem in his community.

MR. FRANK MURPHY, president of the Omaha & Council Bluffs Street Railway Company, the Omaha Gas Company and the Merchants' National Bank of Omaha, died suddenly from an attack of nephritis, December 12, while in New York on a business trip. The body was removed to Omaha for interment, which took place on Saturday the 17th. During the hour of the funeral all the banks of the city were closed in his respect, all the street cars stopped for a brief period, and in the afternoon a public memorial meeting, attended by the most prominent citizens of the city and State, was held in the City Hall. Mr. Murphy was born in Wheeling, W. Va., in July, 1843; for a time he lived and was educated in Pennsylvania, and later resided in Illinois and Iowa. He went to Omaha in 1857, making the latter city his home continuously thereafter. Casting his lot with the pioneers of the West, he was identified with nearly every public movement and enterprise which has brought that section so prominently to the front. Although becoming a foremost citizen of the city and State in influence and wealth and participating actively in all his large and varied business affairs, he was quiet and unostentatious in his private life. He never married, but maintained a fine home where he lived with his sister, the widow of the late Governor Cuming, who was one of Nebraska's first executives. One who had long known him says: "The chief trait of Mr. Murphy as a business man was his singular ability to foresee things and to listen and never talk. He was always waiting to hear what others said. He was a man of tremendous reserve, but equally a man of firmness and steadiness. Once his decision was made it was unchangeable. No alluring prospects could alter or shake his judgment. He was a man who worked from the bottom up on all problems, great and small." A commercial newspaper makes this comment: "Were as much effort used during a man's lifetime to aid him in upbuilding the world, as to praise his unassisted efforts after he has risen from earth, the press would confer a much greater benefit on living humanity. To praise a man's life works after he has ceased his labors is commendable. To aid man in his lifework is the highest fulfillment of the commandment of the Divine Being. Frank Murphy aided men during his lifetime. No greater words of praise can be bestowed upon his career and personal character than the sentiment conveyed in these few words. In the history of electrical and other public enterprises and financial interests in the City and State his name will ever have an honored place."

Trade Publications.

W. N. MATTHEWS & BROTHER, of 801 Carleton Building, St. Louis, state that they are working on a new 32-page catalogue devoted entirely to the Stombaugh guy anchor. It is to be the most attractive piece of literature that this enterprising firm has sent out. They expect to have it ready for distribution about March 1. It will prove of interest to those who have poles to anchor. It will be sent on request.

THE NEW PENBERTHY CATALOGUE.—The Penberthy Injector Company, of Detroit, has recently issued a new catalogue which describes and illustrates their entire line for the year 1905. Besides the well-known Penberthy automatic injector, familiar to so many steam users, it lists and describes a very full line of steam specialties, including the Penberthy autopositive injectors, ejectors, force-feed oil pumps, oil and grease pumps, high and low-water alarms, water gages, gage cocks and other engine-room necessities. The catalogue is conveniently indexed and is well printed and handsomely illustrated.

TELPHERAGE BETTER THAN TRACKING.—The United Telpherage Company, 20 Broad Street, New York City, has just issued a timely and pertinent postal card, illustrating how easily the telpherage system of handling freight operated during the recent blizzard, while tracks all around it were snowed up and utterly incapacitated for business. The company has also just issued a handsome large quarto pamphlet, oblong in shape, illustrating and describing the application of its telpherage methods to a variety of manufacturing industries. A number of plants are shown, several of which have already been noted in these pages. The pamphlet makes a surprising revelation of rapid progress in the development of the telpherage art.

STANDARD WIRING.—Mr. H. C. Cushing, Jr., author of the hand book, "Standard Wiring for Electric Light and Power," as adopted by the fire underwriters of the United States, has just brought out the 1905 edition of this book, completely revised to date. Mr. Cushing, in revising this new edition, was successful in securing the services of Mr. F. E. Cabot, secretary of the Boston Board of Fire Underwriters and chairman of the electrical committee of the Underwriters' National Electric Association, to assist him with that part of the book which treats of the underwriters' rules and requirements. He also had the assistance of Mr. George T. Hanchett, consulting electrical engineer and member of the American Institute of Electrical Engineers, in checking up and revising the many valuable rules and formulæ to aid practical wiremen and contractors in determining the proper sizes of wires for all manner of construction work for both alternating and direct currents. This new edition, like all previous editions, is handsomely bound in flexible leather cover, and makes a most complete and accurate pocket companion for the practical electrical engineer, central station man, wireman and contractor, as well as an accurate guide for the architect and builder, many of whom are now called upon to embody, in their specifications and their plans, provision for the electrical construction in buildings and structures of all kinds. "Standard Wiring" is recognized all over this country as the authority on electrical wiring and construction, being the only book on the subject which is revised and brought up-to-date every year.

News of the Trade.

CHICAGO SOLDER COMPANY.—The name of the Kester Electric Manufacturing Company has been changed to the Chicago Solder Company.

THE FRICK COMPANY has been awarded by the St. Louis Exposition two gold medals, one for its saw mill machinery and one for its threshing machinery.

THE POWER SPECIALTY COMPANY, of New York, manufacturer of the well-known Foster superheaters, has opened a Boston office in the Delta Building, 10 Postoffice Square, in charge of H. S. Brown.

THE WADEFORD ELECTRIC COMPANY, Chicago, Ill., has been organized to conduct an electrical construction business. J. M. Castle, George Lackie and Frederick S. McClory are the incorporators.

THE SCHAEFFER & BUDENBERG MANUFACTURING COMPANY, of Brooklyn, N. Y., manufacturer of speed indicators and other engine and boiler appliances, has been awarded the grand prize by the St. Louis Exposition jury.

THE HOWARD MINIATURE LAMP COMPANY, which makes all types of miniature incandescent lamps, and which has at the proper season produced some very attractive novelties, has changed its address to 58 and 60 Reade Street, New York City.

OIL FILTERS AT ST. LOUIS FAIR.—The Burt Manufacturing Company, of Akron, Ohio, has just received a very flattering testimonial from the DeLaval Steam Turbine Co., in reference to its large American oil filter, which it used in its exhibit at the St. Louis Exposition.

PASS & SEYMOUR COMPANY.—The New York office of the Pass & Seymour Company was removed February 1 to 1322 Havemeyer Building. It is in charge of Mr. W. Brewster Hall, who has had much success in keeping the Pass & Seymour Company specialties before the electrical trade in New York City.

COLUMBIA INCANDESCENT LAMP COMPANY, of St. Louis, Mo., has moved its Memphis (Tenn.) office into new quarters at Suite 302, Scimitar Building. It is in charge of Mr. G. R. Newcomer, who is fully equipped to look after the requirements of its large and constantly increasing trade throughout the South.

THE NILES-BEMENT-POND COMPANY will, about May 1, remove its offices from 136 Liberty Street to the New Trinity Building, where the company will occupy an entire floor as its offices. The company intends to do away with its New York City salesrooms, which now are located on the ground floor of 136 Liberty Street.

THE LINCOLN ELECTRIC COMPANY, of Cleveland, Ohio, has outgrown its old quarters and moved to 49 Wood Street, where it has a more convenient establishment double the size of the old one. It is also fortunate in having enough business in hand to keep its new shop with its increased capacity busy for some time to come.

THE ATLANTIC MILLS, Providence, R. I., have just received a 90-gallon Cross oil filter from the Burt Manufacturing Company, of Akron, Ohio, making the fourth order which they have placed with this concern. It is stated that these filters are netting the Atlantic Mills a handsome saving on the vast amount of lubricating oil which they use.

H. O. S. ENGINEERING COMPANY, of which Mr. H. O. Swoboda is president, has removed its factory and general office from 88 Warren Street, New York, to 16-22 Boyden Place, Newark, N. J., where it will be able to manufacture its line of lighting and switchboard specialties to better advantage. It has installed there a very complete plant, which will enable it to satisfy the trade much better than heretofore in every respect.

MATHIAS KLEIN & SONS, of 87-89 Van Buren Street, Chicago, have issued a caution calling attention to the fact that all their linemen's tools, climbers, etc., are stamped with the firm name thus, M. Klein & Sons. They say: "There are tools on the market stamped 'Klein's Pattern,' and a number of climbers have been sent to us in a defective condition which we have been asked to replace. Evidently the owners were under the impression that they were made by us."

S. F. ALDEN & COMPANY, Rialto Building, San Francisco, Cal., Pacific coast agents for the Davis & Fernum Manufacturing Company, of Waltham, Mass., report the sale of three steel gas holders, with a total capacity of 1,400,000 cu. ft., to the California Gas & Electric Corporation. The shipping weight of these holders will exceed 2,000,000 pounds, or about fifty carloads. The contract price approximates $125,000. These holders are a part of the equipment for the generation of power to operate the United Railroads' system.

THE BRASS GOODS MANUFACTURING COMPANY, Union and Nevins Streets, Brooklyn Borough, New York City, manufactures a variety of brass goods for telephone and other electrical purposes. Among the products may be mentioned a little frame for attachment at the back of the telephone mouthpiece, in which is inserted a celluloid card bearing the number of the telephone. Frames of other designs are made for similar purposes; also a hook for holding the telephone directory; brass checks; hanger plates, etc. These goods are neat in appearance and serve useful purposes.

MR. CHARLES L. MICHOD, of Colorado Springs, Col., has been appointed general manager of the Interstate Electric Company's Cuban business, as successor to Mr. J. W. Peterson. Mr. Michod has already assumed his duties at Empedrado 30, Havana, Cuba. The Interstate Electric Company is one of the largest electrical supply and contracting firms in the southern part of the United States, with main offices at New Orleans, and on account of its advantageous location its chances of success in Cuba should be very good. The company now has several large contracts. The largest one is the complete equipment of the sugar plantation, Santa Filomena, with a power and lighting plant; also the first electric railway system installed on any sugar plantation in Cuba.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

(Published first issue of each month.)

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, S. S. Stadtler, 39 S. 10th St., Philadelphia. Next meeting, Boston, 1905.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. C. E. Skinner, New Haven, Conn. Next meeting, New York City, Sept. 19, 20 and 21, 1905.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty Street, New York. Meetings, last Friday each month.

AMERICAN RAILWAY, MECHANICAL & ELECTRICAL ASSOCIATION. Secretary, Walter Mower, 12 Woodward Avenue, Detroit, Mich.

AMERICAN STREET RAILWAY ASSOCIATION. Secretary, T. C. Pennington, 2020 State Street, Chicago.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. S. Barstow, New York City and Portland, Ore.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Chattanooga, Tenn., May 17, 1905.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Montreal, June, 1905.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, George B. Tripp, Colorado Springs, Col.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, E. W. Poole, Bridgeport, Conn. Annual meeting in November.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

ELECTRICAL ASSOCIATION OF NORTH DAKOTA. Secretary, S. J. Fuller, Larimore, N. D.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, F. Fish, Rochester, N. Y.

ELECTRICAL TRADES SOCIETY (Member National Electrical Trades Association.) Secretary, A. P. Eckert, 39 Cortlandt Street, New York. Board of Directors meets second Friday of each month.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, D. Davis, Litchfield, Ill.

INDEPENDENT TELEPHONE ASSOCIATION OF THE UNITED STATES OF AMERICA. Secretary, Frank G. Jones, 48 West Jackson Boulevard, Chicago.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y.

INTERSTATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. M. Coleman, Louisville, Ky.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. S. Porter, Eldora, Ia. Next meeting, Dubuque, Ia., April, 1905.

IOWA TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Des Moines, Ia. Next meeting, March 14, 1905.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, J. E. Davidson, Port Huron, Mich.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 44 Whitesboro Street, Utica, N. Y. Next meeting, Boston, July 19, 1905.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, Dudley Farrand, Newark, N. J. Next meeting Denver, and Colorado Springs, Col., June 6-11, 1905.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, J. H. Neal, 101 Milk Street, Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 114 Liberty Street, New York. Next meeting, Feb. 15, 1905.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, T. R. Mercein, 85 Michigan Street, Milwaukee, Wis.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, T. S. Lane, 536 Ellicott Square, Buffalo, N. Y. Next meeting Albany, N. Y., 1905.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Chas. Currie, Akron, Ohio.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next meeting, Hotel Victory, Put-in-Bay Island, Aug. 16, 17 and 18, 1905.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, C. J. Miller, 620 Shorb Street, Canton, Ohio. Next meeting, Toledo, Ohio, May, 1905.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, G. P. Low, 600 Rialto Building, San Francisco, Cal. Next meeting, Portland, Ore., June 20, 1905.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, C. W. Hobson. Next meeting, Denison, Tex., April, 1905.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, W. B. Brockway, 40 Morris Street, Yonkers, N. Y.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, W. W. Cole, Elmira, N. Y.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury, Vt.

VIRGINIA STREET RAILWAY & ELECTRIC ASSOCIATION. President, R. D. Apperson, 723 Main St., Lynchburg, Va.

WESTERN SOCIETY OF ENGINEERS, Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

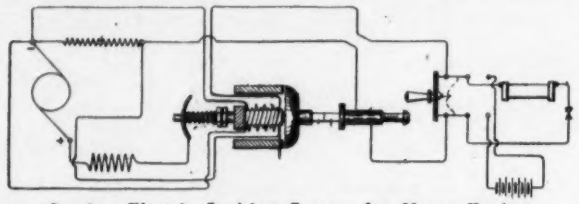
Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JANUARY 17, 1905.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St., N. Y.]

780,322. ELECTRICAL DENTAL INSTRUMENT HOLDER; Monroe N. Callender, San Francisco, Cal. App. filed Nov. 3, 1904. A dental instrument communicating with a source of current through a flexible cord, the latter being adapted to be wound upon a spring drum when the instrument is out of use and the instrument itself mounted upon a clamp fitted to the face of the box containing the drum.

780,386. ELECTROMAGNETIC TRACTION DEVICE; George W. Thompson, Melrose, Mass. App. filed July 26, 1904. The traction of friction between two wheels whose peripheries rest in contact with each other, is increased by a magnet shaped as a semi-ring, embracing one of the wheels and with



780,555.—Electric Igniting System for Vapor Engines.

its poles so located as to concentrate the magnetism at the point of contact between the two wheels; thus when the current is flowing through the magnet, power can be communicated from one wheel to the other.

UNITED STATES PATENTS ISSUED JAN. 24, 1905.

780,500. ICE BOX WATER ALARM; Alfred K. Heilmann, Stamford, Conn. App. filed Feb. 26, 1904. A float carrying the contacts is confined in a guide that is pivoted to the bottom of the ice box so that the drip-pan can be removed without displacing the guide.

780,502. THIRD RAIL; Alfred H. Hopkins, Chicago, Ill. App. filed Nov. 18, 1904. The rail is an ordinary T-rail, inverted, and supported at the upper end of a bracket by bolts passing through the web of the rail.

780,503. CONTROLLER FOR ALTERNATING CURRENT ELECTRIC MOTOR; Ray P. Jackson, Wilkinsburg, Pa. App. filed June 6, 1904. (See Current News and Notes.)

780,504. CONTROLLER FOR ALTERNATING CURRENT MOTORS; Ray P. Jackson, Wilkinsburg, Pa. App. filed June 6, 1904. (See Current News and Notes.)

780,507. APPARATUS FOR TESTING THE INSULATION OF COILS; Edmund W. Kellogg, Newtonville, Mass. App. filed Oct. 6, 1904. Two secondary circuits each containing a telephone and one containing a known resistance while the other is to include the resistance to be tested, are included in this apparatus. The test is made by noting the difference in sound in the two telephones when the primary circuit common to both secondaries is interrupted.

780,523. CONTACT FOR ELECTRIC HAND LAMPS; George L. Patterson, New York, N. Y. App. filed April 6, 1904. A bull's eye lamp having a convenient switch that can be locked and unlocked with one hand.

780,525. TELEPHONE DIAL; Charles D. Reeve, Grand Rapids, Mich. App. filed June 9, 1904.

780,544. THERMAL CUT OUT FOR ELECTRIC CIRCUITS; Theodore Varney, Pittsburg, Pa. App. filed Sept. 22, 1902. A cartridge fuse in which the fusible strip is under tension longitudinally by springs attached at its ends so that at about the fusing point of the strip a positive break will occur.

780,545. MEANS FOR MEASURING THE ENERGY OF ALTERNATING CURRENT CIRCUITS; Miles Walker, Wilkinsburg, Pa. App. filed Feb. 28, 1903. (See page 254.)

780,547. STARTING SWITCH FOR ELECTRIC MOTORS; John B. Wiard, Lynn, Mass. App. filed May 27, 1904. An automatic switch adapted to change the connections in starting an alternating current motor, being centrifugally operated and housed and protected in a small casing on the motor shaft.

780,550. ELECTROPNEUMATIC CONTROL SYSTEM; Eugene R. Carichoff, East Orange, N. J. App. filed June 30, 1904. A plurality of switches arranged to produce definite changes in the circuits of the translating devices, together with pneumatically actuated mechanism for placing all of the switches under strain, tending to close them, and selective controlling mechanism whereby the switches are permitted to close in a predetermined order.

780,555. ELECTRIC IGNITING SYSTEM FOR VAPOR ENGINES; Albert E. Doman, Elbridge, N. Y. App. filed July 7, 1902. An electro-magnetically variable resistance in the circuit of a dynamo, used to furnish the sparking current for an explosion engine.

780,568. METHOD OF CONTROLLING ELECTRIC RAILROAD BRAKES; John S. Lockwood, Kansas City, Mo. App. filed April 16, 1903. An electro-magnetic brake in which the current is alternately and rapidly increased and decreased in the application of the brake to prevent locking of the wheels.

780,580. CONTROL OF ELECTRIC MOTORS; George W. Remington, Schenectady, N. Y. App. filed June 26, 1902. A plurality of motors connected in series parallel, the groups in series comprising different numbers of motors in parallel, a variable shunt about each group, containing a smaller number of motors than the maximum, and means for automatically varying the shunt to maintain the proper current per motor.

780,601. CENTRAL SUPPLY TELEPHONE SYSTEM; William W. Dean, Chicago, Ill. App. filed March 22, 1901.

780,620. TROLLEY WIRE FINDER; Joseph P. Reed, Muncie, Ind. App. filed Sept. 17, 1904. Details.

780,622. ELECTRIC SIGNALING DEVICE FOR RAILWAYS; Georges Schreiber, Boubaix, France. App. filed April 25, 1902. Details.

780,641. AUTOMATIC ELECTRIC SWITCH; Egbert R. Dull, Chicago, Ill. App. filed Jan. 12, 1904. This is a "flasher" switch, the invention having to do with the relative movements of carbon and metallic contacts to prevent arcing.

780,663. METHOD OF OPERATING PRINTING TELEGRAPH RECEIVERS; John M. Joy, New York, N. Y. App. filed Aug. 1, 1902. The method consists in transmitting alternating currents over the line for selecting the characters to be printed, then changing from alternating current to direct current and automatically increasing the normal strength of the direct current momentarily to print the character selected.

780,664. PRINTING TELEGRAPH RECEIVER; John M. Joy, New York, N. Y. App. filed Aug. 5, 1902. Various improvements in page printers.

780,678. INCANDESCENT LAMP SOCKET; Henry E. Meyers, Denver, Col. App. filed Dec. 11, 1902. An automatic switch in the socket of a two filament lamp, adapted for flashing purposes.

780,679. APPARATUS FOR TELEPHONE SWITCHBOARDS; Frank R. McBerty, Evanston, Ill. App. filed Jan. 26, 1901. The present invention consists in utilizing each step of the series of steps that has to be performed by the central operator, to establish a condition of mechanism adapted for the performance of the next step.

780,687. AUTOMATIC MEANS FOR PLAYING MUSICAL INSTRUMENTS; Harold W. Shonnard, New York, N. Y. App. filed Dec. 10, 1902. Details of construction of a coin-operated musical instrument.

780,698. ELECTRIC RAILWAY; Frank Anstett, Wilkesbarre, Pa. App. filed Aug. 9, 1904. Details.

780,713. SIGNALING SYSTEM IN TELEPHONE PLANTS WITH CENTRAL BATTERY; Alfred Ekstrom, Stockholm, Sweden. App. filed Oct. 20, 1902. (See page 254.)

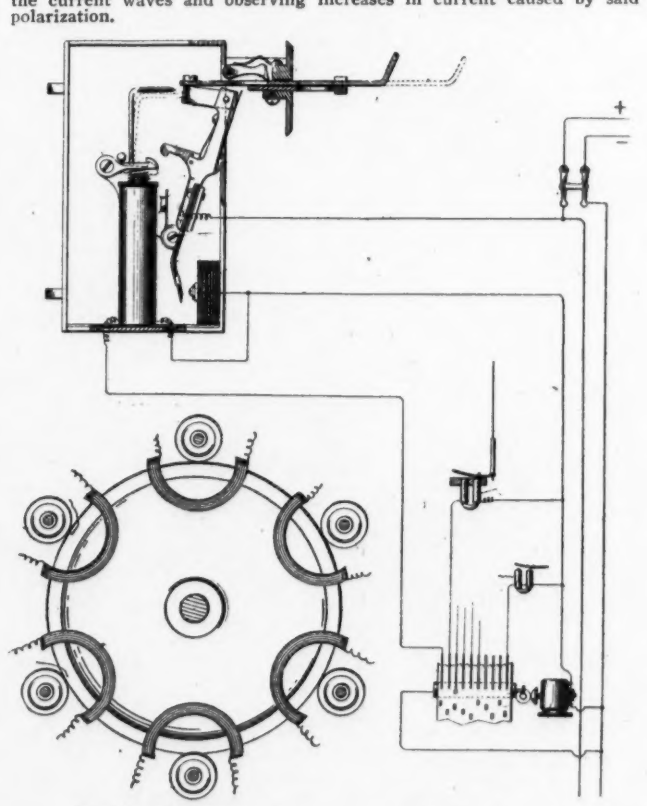
780,716. METHOD OF AGGLOMERATING MAGNETIC ORE; Elmer Gates, Chevy Chase, Md. App. filed Jan. 14, 1901. Magnetic sand is permitted to flow from opposite directions through a throat in which an electric arc is formed; the arc in passing from one body of sand to the other fuses the particles into lumps of a size more conveniently manipulated in subsequent treatment.

780,767. ELECTRIC RAILWAY TROLLEY; Russia R. Weeks, Cincinnati, Ohio. App. filed April 14, 1904. Details.

780,769. ELECTRIC METER; James J. Wood, Fort Wayne, Ind. App. filed Feb. 11, 1904. Various improvements in meters of the induction motor type tending to make them less liable to derangement, to make the parts readily accessible and to prevent injury from the vibration incident to the alternating current.

780,770. ELECTRIC METER; James J. Wood, Fort Wayne, Ind. App. filed May 10, 1904. A clamp applied to the lower end of an armature spindle for sustaining the spindle when it is out of its bearing.

780,842. METHOD OF RECEIVING ELECTROMAGNETIC WAVES OR OTHER FEEBLE SIGNAL IMPULSES; Frederick K. Vreeland, Montclair, N. J. App. filed Aug. 1, 1904. The method consists in polarizing an electrolytic cell of minute capacity and then depolarizing the same by the current waves and observing increases in current caused by said depolarization.



780,386.—Electromagnetic Traction Device.

780,687.—Automatic Means for Playing Musical Instruments.

780,852. STATION SIGNAL; John L. Wrenn, Washington, D. C. App. filed Nov. 24, 1903. The signal is set by an intending passenger and is restored automatically after a given time by an hour-glass arrangement.

780,860. PUSH BUTTON; Edward Brusseau, Jefferson, S. D. App. filed April 18, 1904. Details.

780,870. MAGNETIC SEPARATOR FOR ORES OR SIMILAR MATERIALS; John T. Dawes, Liverpool, England. App. filed Dec. 28, 1903. The ore in granular form passes over a drum over one portion of the surface of which a magnetic disk overlaps; a magnet draws the magnetic particles of ore against the disk which carries it to one side and out of the range of the magnet and drum, where it can drop into a special compartment.

780,885. RAILWAY ELECTRIC SIGNAL; Slaughter W. Huff, Baltimore, Md. App. filed Jan. 17, 1898. Various improvements in an automatic signalling system wherein the track rails, various wire circuits, a number of relays and sources of current are utilized to control the signals.